



Science, the endless frontier of regulatory capture

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ABSTRACT

In this paper we explore five recent cases of regulatory capture in Europe and zoom in on a form of corporate penetration which is based on a strategic use of the image and legitimacy of science. We examine cases in which lobbyists present themselves as upholders of science and of evidence-based policy, intervene directly in the methodological and ethical aspects of science for policy-making, thus imprinting their own agenda on the societal functions of science. We propose the existence of a process whereby private interest ascend an ideal 'epistemic ladder'. In this vision, lobbying intervention moves from questioning the evidence to questioning its legitimacy, all the way to acting as to create a worldview where not only the evidence, but the very idea of regulation, become irrelevant or undesirable, other than as a vehicle for the pursuit of private interest. Caught in this project, science and its future appear vulnerable.

1. Introduction

Regulatory capture is the practice whereby private industry professionals or lobbyists overtake regulatory agencies to serve their own interests. Regulation is normally studied in economics, where it has been explained by two main theories: public interest theory and regulatory capture theory. Public interest theory is based on the assumptions of market failures and of a greater ability of regulatory intervention to remedy these failures. Regulatory capture theory defines regulation as a result of particular interests which are favoured by it. Its assumptions are drawn from the observation that regulated sectors are not always characterized by market failures.

What is less explored is the peculiar role played in the regulatory capture by knowledge and science, considered as new currency of lobbies, and how regulatory capture has changed in scope and influence. Less attention is also paid to the role of information as a carrier of institutional authority, able to armour and crystallize what has been called the technocratic orthodoxy (van Zwanenberg, 2020).

Using a multidisciplinary approach, drawing from the literature on regulatory capture produced in economics, as well as from sociology of science studies, we address how processes and practices of regulatory capture have changed in speed, scope and subtlety¹, mostly in relation to the science, or more generally to the evidence, which is needed by regulators. We also claim that information as a

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¹ The title of the present work alludes to a famous report penned by Vanevar Bush for President Roosevelt in 1945: "Science, the endless frontier".

currency has played a key role in the methodology of capture, and in the ethics and governance of regulation, changing the frame of regulatory capture. We identify in this transformation a progression which we call ‘epistemic ladder’. Based on five test cases (Table 1), we shall discuss new strategies of lobbying which target spaces where science is produced as a source of evidence for policy-making, where its governance is debated, and its ethical implications are negotiated, all the way to targeting directly the societal functions of science. The steps of the ladder ascended by lobbyists are illustrated by our test cases, all involving the practice, the governance and the social image and function of science (Table 2).

The capture of the scientific methodology to be used in regulation is illustrated in the case **Neonicotinoids**, that of ethics in the case **Artificial Intelligence (AI) Washing**, and that of governance in the two cases of the **Brussels Declaration**, and of the **EU scientific advice**. Finally, we illustrate the most ambitious strategy: that of societal capture of science’s image and function in the case of the **Innovation Principle (IP)**. An alternative way of looking at this ladder is to say that the strategy of lobbyists has progressively moved from just appropriating science all the way to influencing the relation between science and regulation, the governance of science itself, and ultimately science and society. In this last leap, corporate lobbying can be seen exploiting existing contradictions in the relation between science and society, with the conflict between the ideals of the Enlightenment and the practices of entanglement between science and private interests (Beck, 1992, Ravetz, 2011, Toulmin, 1992). This is done by deploying to their full extent the power of the new media in order to defend private interest while posing as ‘Guardians of Reasons’ (Foucart, Horel, & Laurens, 2020). The ‘enemies of science and progress’ fought by the new guardians are those who militate in various causes, be these ecological, societal or political, where private interest is threatened. Before moving to our ladder and test cases, we recall some previous works, touch on the concept of ‘cultural capture’ and discuss recent work on science as ‘the currency of lobbies’.

2. The multi-dimensionality of regulatory capture

For a humanist reader, Juvenal’s ‘Quis custodiet ipsos custodes’ is the first appearance of the problem of how to control the controllers in the classic literature (second century AD). This phenomenon has been observed practically ever since governments started using regulations as a form of behavioural control for well-ordered societies. The ineluctability of regulatory capture² cuts across various schools of economic thought. A review of economic thinking on regulatory capture is offered by Ernesto Dal Bó (Dal Bó, 2006), for whom

...regulatory capture is the process through which special interests affect state intervention in any of its forms, which can include areas as diverse as the setting of taxes, the choice of foreign or monetary policy, or the legislation affecting R&D.

George J. Stigler (Stigler, 1971), an exponent of the so called ‘regulatory capture school’, built his work on that of Marver H. Bernstein – who proposed a first general theory of the life-cycle of regulatory institutions (Bernstein, 1955) in the United States, generalising Gabriel Kolko’s analysis of railroads and regulation (Kolko, 1965). A leader of the Chicago School of Economics, Stigler contended that “regulation is acquired by the industry and is designed and operated primarily for its benefit”. This theory studies the mechanisms which lead to a regulatory act by identifying the interest groups that profit from the redistributive effects that the act entails.

Like Bernstein (Bernstein, 1955), Beryl R. Crowe (Crowe, 1969) also hints at the existence of a cycle whereby a new institution, say an agency, is first created as a result of a period of social alarm and concern, so that the newly established regulator can defend the social or environmental issue under its remit for the common good. Eventually, highly organized and specifically interested groups take control, converting the agency to the protection and furthering of their own interests. In the final phase, even the staff of the agency comes to be selected from among the ranks of the interest groups it should regulate. Once this status of affair is established, notes Crowe, the regulator ends up providing the general public with symbolic satisfaction and assurances, while “their actual day-to-day decisions and operations contribute, foster, aid, and indeed legitimize the special claims of small but highly organized groups” (Crowe, 1969).³

The already mentioned Stigler, economist of neoliberal orientation, concludes that it is better not to create regulatory bodies in the first place – to keep governments small, while their opponents will insist on tackling and possibly solving the problem of who controls the controllers – e.g. with practices such as better compensation for regulators, legislative committees that specialize in monitoring the regulator, and possibly the creation of consumer advocate groups (Dal Bó, 2006). Paul Sabatier (Sabatier, 1975) criticizes and enriches the analysis offered by Bernstein (Bernstein, 1955) by noting that regulators have at their disposal an important strategic option: that of taking “active measures to reinvigorate and/or create a constituency supportive of aggressive regulation”. Sabatier offers as an

² A search for “regulatory capture” on Google Scholar returns about 27,600 hits. As a litmus test of the social cost of regulatory capture, suffice it to read the two volumes of the European Environment Agency reports titled “Late Lessons from Early Warnings” of 2002 (European Environment Agency, 2002) and 2013 (European Environment Agency, 2013). Though the expression “regulatory capture” is hardly ever used (only once, in the 2013 volume, in relation to the Fukushima accident) the effects of capture are evident in most chapters, from the benzene and asbestos chapters in the 2002 volume to the beryllium and tobacco chapters in the 2013 volume.

³ Just a few years after Crowe formulated this stark vision of the role of regulators, B. M. Owen and R. Braeutigam, two experts working for the regulated industries, wrote “The Regulation Game: Strategic Use of the Administrative Process” (Owen & Braeutigam, 1978). A first teaching of this work, addressed to industrial and commercial actors, is that economic agents should embrace, rather than resist, administrative and regulatory processes, as these subtract the actors from the vagaries and the competition of the markets, fostering the maintenance of the status quo and of the power of the incumbents. The book also instructs lobbyists on how to approach and enrol the best disciplinary experts, i.e. scientists, to defend the positions of the regulated industry.

Table 1Case studies, questions and methods: IJ = Investigative Journalism¹⁷, LR = Literature review.

Case study	Questions	Method
1 Neonicotinoids	<i>In the battle for which evidence counts, how can lobbies mobilize experts, regulators, scientific journals and the media?</i>	LR
2 EU science advice mechanism	<i>Can science advisors resist lobbyists?</i>	IJ
3 Ethics washing: Guidelines for Artificial Intelligence (AI)	<i>Are scientific ethical committees venue lobbyists?</i>	LR
4 Brussels Declaration	<i>How can representatives of the alcohol and tobacco industry infiltrate the agenda of science governance?</i>	LR
5 Innovation principle (IP)	<i>How can corporate influence lead to the creation of a new EU principle?</i>	IJ

Table 2

The epistemic ladder of capture.

Case	Strategies	Resources	Dominion targeted
1 Neonicotinoids	Epistemic. Invalidating the inference or influencing the methods whereby the evidence is produced	<i>Specialised firms or agencies, ‘merchants of doubt’, defenders of ‘sound epidemiology’, captured scientific journals (Heath, 2016)</i>	Science quality criteria and epistemology
2 The EU science advice mechanism 3 Ethics washing: Guidelines for AI 4 Brussels Declaration	Institutional. Delegitimising the institutional settings which produces the evidence or otherwise ‘colonising’ it	<i>Science advisory workers able to populate scientific ethical committees and to influence the agenda of science governance</i>	Science governance
5 Innovation principle	Political. Changing the framework or the worldview in the context of which the evidence – or the very idea of regulation - are relevant or desirable	<i>Intellectuals, policy brokers (Surel, 2000), disciplines (cognitive psychology and behavioural sciences), defenders of science (organizations and individuals), trolls and bots for astroturfing</i>	Cultural capture Relation between science and society

example the successful strategy of the National Air Pollution Control Administration in the United States (US) to gather a supportive constituency so as to implement a more aggressive policy. Overall, this scholar sees the emergence of consumer organizations, environmental groups (the Clean Air Coordinating Committee of Chicago is given as an example), and public interest law firms as the actors able, albeit with difficulty, to counteract the cycle of decadence of public support that facilitates capture in Bernstein’s theory (Bernstein, 1955).

Mitnick (2011) develops a thorough taxonomy of the mechanisms for capture articulated into twelve mechanisms, sorted into six logical groups, ordered from the more institutional/systemic to the more individual and functional. Science does not play a major role in this work as than to note the importance of competent scientific staff to the reputation of a regulator (p. 44). Cultural capture can also be achieved by the creation of epistemic communities, including “technically competent regulatory experts from science, professions, business and NGOs” (Braithwaite & Drahos, 2000), p. 29.

A somewhat more recent concept is that of ‘regulatory capitalism’, intended as a new global world order where the importance of rules as a source of power has increased in scope, is seen by some as allowing a more balanced approach to the distribution of power and resources in favour of the global poor (Levi-Faur, 2005), while others frame it as an act of the tragedy of commodification (Drahos, 2020), made possible by a subservient and commodified science (Mirowski, 2011). An aspect of the commodification of knowledge well captured by (Braithwaite & Drahos, 2000) is how “the principle that knowledge is the ‘common heritage of mankind’ was defeated by shifting intellectual property issues from UNESCO and UNCTAD to the World Intellectual Property Organization and the GATT (General Agreement on Tariffs and Trade), where knowledge was treated as property subject to trade principles.”

2.1. Cultural capture and the “guardians of reasons”

Much interest surrounds today the issue of cultural capture, also known as cognitive capture. As noted by Dal Bó (2006)

Regulators may come to view the world the way firms do, not because they have been captured through incentives, but because they have been convinced.

A similar view can be found in Mitnick’s work ‘Capturing capture’ (Mitnick, 2011) p. 42. Cognitive or political capture is held responsible, *inter alia*, for having contributed to the latest recession via the lifting of controls on the banking sector, engineered by the sector itself (Kwak, 2013).

Cultural capture is the subject of “Les Gardiens de la Raison. Enquête sur la Désinformation Scientifique”, published in 2020 by two investigative journalists (Stéphane Foucart and Stéphane Horel), and the sociologist Sylvain Laurens (Foucart et al., 2020). The book

illustrates how well-meaning educators, animators of Science Cafés⁴, scientific bloggers or micro-influencers, and even associations driven by a desire to uphold and defend the virtues of a scientific worldview, are hijacked by corporate lobbyists to the effect of defending industrial positions on issues ranging from the regulation of herbicides to genetically modified crops, from nuclear energy to climate. All these actors become the new, industry-sponsored ‘Guardians of Reason’. The French authors consider the new strategies unprecedented and fast moving (*rapides et inédites*), a new frontier of lobbying, where the new game consists in colonizing the entire space of scientific intermediation. Foucart and co-authors describe how an army of self-proclaimed ‘fact checkers’ becomes mobilized in the defence of a neoliberal and conservative credo, posing as victims of an assault on science perpetrated by the purported enemies of reason. For the French authors, an important element of this credo is a neo-rationalism of libertarian orientation, whereby those who express concern about threats to health and the environment due to industrial actors are labelled as retrogrades, luddites, or propagators of ‘fake news’. Such a worldview, note the authors in one of the most penetrating chapters of the book, is sustained by the expanding efforts and prevalence of scientific disciplines such as evolutionary psychology and cognitive psychology⁵.

In her book ‘Surveillance Capitalism’ Zuboff (2019), makes a very similar case (chapter 12) of how cognitive psychology, once coupled with the algorithms of artificial intelligence (AI) and big data, realize what she calls ‘instrumentarian power’, permitting to the owners of the great platforms the realization of what she presents as a project of total domination over society.

2.2. Knowledge as the currency of lobbies

In classic regulatory capture studies, the issue of knowledge asymmetry mostly concerns prices; the industry knows its prices while regulators have to discover them. A regulator may become a ‘populist’ when underestimating prices – and thus damage the industry by imposing prices which prevent investment or innovation, or too complacent in accepting the industry’s declared prices, thus damaging consumers (Dal Bó, 2006).

A different sort of knowledge asymmetry has become a more recent subject of study. Both in Europe (Laurens, 2017) and in the US (Drutman, 2015) different scholars have noted how evidence can become a currency, which lobbyists use to purchase political leverage. This is due the asymmetry of knowledge and research resources between the corporate powers and regulators or politicians: an individual congressmen or woman, a staffer or civil servant may lack the information, often the crude data, which would be needed to design policy options. In these situations, the friendly lobbyist, provided with both, gains access and leverage: knowledge and science have become – in the words of Sylvain Laurens – the currency lobbies (Laurens, 2017), a point made for the US case by Lee Drutman (Drutman, 2015).

In Europe, the main focus of the present work, noticeable cases of instances where corporations’ strategy extends beyond regulatory agencies to target the very instances where the governance of science itself is formulated – from ethical committees to working parties debating the use of science for policy-making – are the Brussels Declaration (World Science Forum, 2017, Bero, 2018, McCambridge, Daube, & McKee, 2018), the so-called ‘ethics washing’ of the guidelines for AI (Metzinger, 2019), and the saga of the ‘innovation principle’ (Holland, 2018, Garnett, Van Calster, & Reins, 2018). For more background on lobbying in the European Union see also Klüver (2013).

3. Methodology

We have based our analysis on five selected case studies (Table 1), to detect how information, knowledge and science take centre-role and function, reframing regulatory approaches and strategies. All cases refer to a period from 2009 up to 2019.

The three case studies, concerned with the Brussels Declaration, ethics washing, and neonicotinoids, are based on the analysis of bibliographic sources and official documents, including academic articles, books and commentaries from the general media.

Two case studies, that of the innovation principle and the one of the EU science advice mechanism, benefit from the direct investigative journalism of two of the authors (NH and MP) involving recourse to the freedom of information (FOI) legislation enshrined in Article 15 of the Treaty on the Functioning of the European Union (European Commission, 2012). We consider this method able to partly open the black box of relationships between lobbies and public institutions. In the case of the innovation principle the links to the material obtained via FOI can be found at the end of the analysis of Holland (2018).

The case studies illustrate how lobbyists manage to refine and sophisticate their cultural penetration and capture strategy, colonizing higher steps of the science for policy system (Table 1). The metaphor of climbing an ideal epistemic ladder (Table 2), discussed after the cases, is proposed to illustrate the novel configuration of these strategies.

⁴ “Science Cafés are events that take place in casual settings such as pubs and coffeehouses, are open to everyone, and feature an engaging conversation with a scientist about a particular topic”, <https://www.sciencecafes.org>.

⁵ Steven Pinker’s work is offered by the French author as an example of how the intellectual edifice of techno optimism is built (Pinker, 2018). In his work Pinker - de facto a champion of the guardians of reason, attacks unceremoniously as ‘cultural pessimists’ several centuries of humanist, philosophical and ecological thought. See for a discussion (Gray, 2018; Lent, 2018).

4. The cases

4.1. First case. Neonicotinoids: who sets the tests?

Battles about whose truth counts come to be fought in the arena of the methodologies employed – pointing to the evident non-neutrality of techniques or methods (Saltelli et al., 2020). The expression “sound science” was coined by the tobacco companies to fight evidence of the effects of second-hand smoking, which was instead defined as “junk science” (Ong & Glantz, 2001). The same lobby also introduced the “good epidemiological practices”, again with the aim to suggest practices which would not indict their products (Ong & Glantz, 2001).

A present case of environmental crisis is the so called ‘insectageddon’ (Monbiot, 2017). This is an observed decrease in insect populations, jeopardizing our ecosystems as well as our food security, given the great variety of staples used for human consumption which are pollinated by insects. Older readers may remember the time when a driver had to stop to clear the windshield of dead insects when traveling through the countryside (Vogel, 2017), while this is no longer needed today. This gives a very empirical sense of the scale of the problem. One of the main agents deemed responsible – among other possible causes and synergetic effects – is a class of insecticides known as neonicotinoids, which has become important over the last twenty years (van der Sluijs et al., 2013). How the effect of these agents is measured in regulatory science is a point of contention. While the foraging area of bees may extend over up to 9 km away from the honeybees, and the impact of insecticides implies bioaccumulation and hence long term effects, the prevailing measuring techniques held valid in regulation fail to detect the toxicity of these insecticides (van der Sluijs et al., 2013). This was instead identified by scientists in both laboratory and field environments over more realistic conditions of exposures (Whitehorn, O’Connor, Wackers, & Goulson., 2012). Different parties – from ministries of agriculture to pesticide producers to honeybee owners – argue for different causes and symptoms (Maxim & van der Sluijs, 2010).

In fact, in the EU, there is a dual assessment system for pesticides and their active substances which involves an EU-level first step of approval for active substances, followed by a full pesticide regulation procedure involving EU Member States (plus Norway). The latter are divided into three zones which are judged similar by ‘agricultural, plant health and environmental conditions’. This last step involves the member states’ competent authorities.

Olivia Hamlyn notes (Hamlyn, 2019):

Differential transparency between industry generally and civil society may also have consequences. Private, economic actors (applicants) provide the majority of the information on which authorisation decisions are based.

While this provision may correspond to the industry having more data and resources than the regulator, it may

...raise concerns regarding information asymmetry and the potential for industry to frame or manipulate regulator perceptions through the supply of selective or biased information.

For Hamlyn (2019), close contacts between industry and competent authorities is natural and necessary for expedited processing of applications, and comments:

However, industry itself is largely free from public oversight and norms militating towards openness or acting in the public interest, raising concerns regarding accountability ... Such collaboration may decrease the relational distance between regulator and industry, potentially increasing the risk of capture. (Hamlyn, 2019)

The limitations and dangers of the present pesticides regulatory regime in the EU are well captured by a white paper (Robinson et al., 2018) prepared for the ‘Citizens for Science in Pesticide Regulation’ and signed by a group of scholars gathered under the Pesticide Action Network Europe. The paper identifies several shortfalls – both structural and methodological, including the blatant conflict of interest, the scope for opacity and the asymmetry of power of the present system, whereby national experts can be found marking their own homework (p. 14), and the absence of post-evaluation monitoring. On the methodological side, the paper identifies use and abuse of unverified model-based tools and predictions (p. 3), and the ignoring of both the effect of pesticide mixtures and the formulation discussed above. Overall, the white paper calls for transparency and institutional remedies, including the closure of the many loopholes which allow non-neutral experts and staff to participate in the works of the European Food Safety Agency (EFSA) and of the national authorities, *de facto* permitting conflicts of interest to go largely unregulated ((Robinson et al., 2018), p.13–15). A route for civil defence from corporate abuses is offered by Citizens’ Initiatives, allowed by EU law, also in relation to pesticides (Anon., 2017).

It needs to be said that, in the EU context, there are structural reasons for the EFSA and European Commission commitment to a ‘sound-science’ approach to regulation. These are summarized by van Zwanenberg (2020) as follows:

- In its commitment to the single market, the EC needs a centralized, hence standardized, risk assessment approach.
- A pro-biotech agenda could be upheld by both the EC and EFSA in the interest of EU growth and competitiveness.
- A fear that abandoning a strict standardized approach may open the road to endless deconstructions of EU policies, leading to more expensive and burdensome regulations.
- A latent form of scientism among officials who sincerely subscribe to a vision of science neutrality – so that critical voices must be either ‘hidden interests’ or ‘anti-science’ (Wynne, 2014).

In relation to this last point, Wynne (2014) notes that a political economy of innovation has permitted a lock-in of rigidly pre-defined trajectories in fields such as agriculture and energy.

4.2. Second case. The EU Science Advice Mechanism: Will corporate interests succeed in using scientific advice to influence EU policy-making?

Anne Glover, a molecular biologist, was appointed in 2009 Chief Scientific Adviser (CSA) by J. M. Barroso (President of the European Commission at the time), at the request of the UK government. But the post was only filled in late 2011, at the end of a selection process she characterised as “not transparent” (Glover, 2015). Describing her position to the President of the European Commission (Glover, 2010), she said that “EU policies are much more technical than national policies... Science is therefore dragged into a political battlefield”.

On paper, her function was very powerful, tasked with providing advice, leadership, guidance, monitoring, early warning, all the way to promoting a “European culture of science and technology world-wide” (Glover, 2010). In contrast with the high visibility of her mandate, the means provided to Glover by the European Commission were “close to zero”, only including “an office, a secretary and the support of a temporary seconded national expert” (Glover, 2015).

Her advisory role, by her own account very limited, remained confidential. While her team later expanded to a few more EU employees, this combination of being the highest-ranking source of scientific advice in the European Commission, a prominent public figure on science issues, and not having access to any meaningful resources to double-check the information she was given beyond the area of expertise of her restricted team, made her an ideal lobbying target.

In May 2014, the European employers federation BusinessEurope, one of the largest industry lobby groups in Brussels, wrote to Barroso, asking for a considerable expansion of the role of the CSA (Marcegaglia, 2014), with the argument that “evidence-based decisions, derived from the best available science... provide a predictable policy context”. The two keywords are “best” and “predictable”: they impose admissibility (and therefore exclusion) criteria for “best available science” in order to reduce the policy discretion of public officials and elected politicians.

In fact, the European Commission was upscaling its high-level scientific advisory function, learning from the CSA experience and linking the new system with European scientific academies. The scheme also incorporated the internal criticism from the other EU administrations tasked with delivering scientific advice to the European Commission, such as the European Food Safety Authority (EFSA), concerned about their possible side-lining in the advisory process (Corporate Europe Observatory, 2014).

The European Commission announced the creation of the CSA’s replacement in May 2015, the Scientific Advice Mechanism (SAM) (Corporate Europe Observatory, 2014). This new structure was more transparent, collegial and multidisciplinary, and supported by a dedicated unit within the European Commission’s Directorate for Research and Innovation. Given “a high degree of autonomy including taking its own independent initiatives”, the new “High Level Group of Scientific Advisors” (HLG) no longer had a “science chief” in its name and their interaction with the European Commission was better structured in order to reduce the risks of competition with other EU science administrations.

The group’s first composition was announced in November 2015 and included seven high-level scientists (four men and three women) covering several disciplines including social sciences (Brooks, 2015). The HLG’s work has also been supported since then by a consortium called SAPEA (Science Advice for Policy by European Academies), representing European national academies and learned societies to “ensure the inclusion of all scientific disciplines (social, human, natural, engineering and medical sciences)”. SAPEA produces “evidence review reports” that are preparatory material for the HLG’s output, even though the drafting of the SAM’s science advice publications is only done by members of the HLG and its supporting unit within the European Commission.

A number of questions remain. Being an expanded and more robust version of the CSA, with a strong symbolic power and moral authority, the SAM is inevitably attracting lobbying, but does not seem well equipped to deal with it. SAPEA is not an EU institution and therefore not covered by EU transparency and independence regulations.

A recent SAM publication on scientific advice (Group of Chief Scientific Advisors - Scientific Advice Mechanism (SAM) - European Commission (2019)) states that “Scientific advice needs to be a transparent and impartial process, and to have a clear mandate to ensure that science is separate from politics”, as per a typical industry stance⁶ (Neslen, 2017). In July 2018, the HLG was renamed “Group of Chief Scientific Advisors”.

4.3. Third case. Ethics washing: Ethics Guidelines for Trustworthy AI

Artificial Intelligence, intelligence exhibited by machines, promises to be a foundation of breakthrough insights, as long as the technology works for humanity and not against humanity. On 8 April 2019, the Ethics Guidelines for Trustworthy Artificial Intelligence (AI), (High-Level Expert Group on Artificial Intelligence, 2019)) were made available to the public in 23 languages on the European Commission’s webpage. Thomas Metzinger – one of the authors – praised the guidelines as “the best in the world on the subject [...] The United States and China have nothing comparable”. The same author, a professor of Theoretical Philosophy at the University of Mainz, is nevertheless dissatisfied with the document, as well as with the procedure adopted for its production (Metzinger, 2019). He notes that, for a paper with the word ethics in its title, the presence of just four ethicists in a committee of 52 members appears paradoxical. He laments the “extreme industrial weight” in the “High-Level Expert Group on Artificial Intelligence” and notes that while industry is surely needed in the discussion of a document on AI, “the rudder cannot be left to industry.” Metzinger tells the

⁶ For example, Monsanto refused to attend a hearing in the European Parliament it had been invited to, on the “Monsanto Papers” scandal, by arguing that the Parliament was not “an appropriate forum” for this discussion and deploring “the politicisation of the EU procedure on the renewal of glyphosate,” which “should be scientific but which in many respects has been hijacked by populism”.

story of how the idea of “red lines”, e.g. areas where European AI should not go, such as autonomous lethal weapons, or spying on citizens, was eventually expunged from the document, as well as the expression “non-negotiable”, in the interest of producing what industry representatives and group members identified as a “positive vision”. This – he says – is a case of “ethics washing”:

Industry organizes and cultivates ethical debates to buy time – to distract the public and to prevent or at least delay effective regulation and policy-making.

More in general, for Metzinger, the story of a “trustworthy AI” is a marketing narrative invented by industry as “a bedtime story for tomorrow’s customers”. He concludes that, on balance, the document contains a valuable legal anchoring in European fundamental values, and the enunciation of abstract ethical principles is acceptable, but:

Only the genuine normative substance at the level of long-term risks, concrete applications, and case studies has been destroyed. (Metzinger, 2019)

One is left to connect Metzinger’s dilemma to the context of the previous case study of the EU Science Advice Mechanism (Section 4.2) gone awry: where is transparency and independent science in the definition of “trustworthy AI”?

4.4. Fourth case: The Brussels Declaration

The Brussels Declaration (McCambridge et al., 2018), a statement issued in 2017, originates from an organism called the World Science Forum, and was announced by the American Association for the Advancement of Science (AAAS) in February 2017. It was preceded in January of the same year by an announcement in the journal Nature (Kazatchkine, Kinderlerer, & Gilligan, 2017), which reported that the declaration involved a series of events in the period 2012–2016 attended by more than 300 individuals from 35 countries. The article in Nature also informs that the declaration proposes a 20-point blueprint to assist work at the crossroads between science, society and policy, that it advocates for a multidisciplinary approach, and that it encourages integrity and accountability. The declaration’s preparatory process, reported in the World Science Forum (2017), lists important leaders of scientific institutions, such as the President of the European Research Council, the Former Chief Scientific Adviser to the European Commission President, the Chief Science Adviser to the Prime Minister of New Zealand, the South African Minister for Science & Technology, a long list of cadres from the European Commission and many more. Richard Horton, the Editor-in-Chief of the journal Lancet, also appears prominently in the report. This is where something goes wrong, as the same Horton, in a comment later published in his journal (Horton, 2017), and entitled “Offline: Difficult truths about a post-truth world”, laments that his name, photo, and one of his statements have been used in a document “whose intention seems to be to undermine the value of science in policy making, and was created with the input of industries that are anathema to health”. What happened?

Horton had been made aware of a strong presence of alcohol and tobacco lobbies in the preparation of the declaration. In our understanding, this presence explains passages in the Declaration such as:

Scientists must learn to use established communication channels for providing policy advice more effectively and be less aloof and perhaps less arrogant.

Scientists need to recognise that they are advocates with vested interests too—in their case, in their own science.

Industry is an investor in knowledge generation and science and has every right to have its voice heard.

Nevertheless, industry is too often perceived as suffering from fatal conflicts of interest and its views are therefore dismissed. In fact, commercial conflicts of interest are fairly easy to deal with if they are properly declared and the relationship between the science and the marketing made explicit. Ideological, personal, or academic conflicts of interest, on the other hand, are much harder to detect or deal with.

... the precautionary principle must not be misused in a way that impedes technological progress towards reducing risk or public harms. (World Science Forum, 2017)

According to (McCambridge et al., 2018) twenty of 165 names listed in the Declaration were from organizations linked to the tobacco or alcohol industries, with other names also being identifiable as close to these companies.

While some of the personalities involved in the declaration only attended the first meeting and had no subsequent involvement in the process, as it became more industry-driven (Bero, 2018), we haven’t been able to identify statements of condemnation of the declaration analogous to Richard Horton’s, either in the journal Nature or from the important European and international institutions mentioned above.

According to Bero (2018), who provides scientists with ten tips to detect the influence of lobbyists, the presence of public relation firms, the ambiguous language used to describe what is a conflict of interest, and the opacity of funding are all signs of the long lobbies’ hand, aimed to redefine scientific standards in order to decrease regulation. Institutions and scientists would be well advised to study those tips before getting on-board with initiatives such as the Declaration.

4.5. Fifth case: the innovation principle

In the EU policy narrative, innovation is key for enhancing the competitiveness of European industry, economic growth and creating jobs. In relation to innovation, industrial actors demand two things from the EU institutions: public funding for research and development, as well as less ‘red tape’ restricting the commercialisation of their products (Böttcher, 2016).

In this context, a new concept was developed by the industrial sector: the innovation principle. The principle advocates for a new form of impact assessment to ensure that “*whenever policy or regulatory decisions are under consideration the impact on innovation should be*

assessed and addressed” (BusinessEurope, 2016).

The innovation principle was elaborated by a cross-sectoral industry lobby group, the European Risk Forum (ERF), representing fossil fuel, chemical and tobacco companies. Before becoming an autonomous organization, the ERF was part of a corporate sponsored think tank, the European Policy Centre (EPC) (Smith et al., 2010). In summer 2018, the ERF removed the tobacco industry (BAT and Phillip Morris) from its membership⁷, and added a few new sectors. This happened shortly after the Corporate Europe Observatory submitted a FOI request to the Commission investigating the ERF’s interactions with policy makers (Holland, 2018).

Here how the ERF summed up its achievements at one event:

In 2013, the European Risk Forum, with the support of CEOs from twenty-two of the world’s largest corporate investors in innovation, launched the Innovation Principle (IP). Actively supported by BusinessEurope and the European Roundtable of Industrialists, endorsed by the European Council and supported by successive EU presidencies, it has achieved significant prominence within the EU institutions. (Holland, 2018).

The innovation principle as designed by the ERF appeared for the first time in an official EU document in late 2015. According to an existing reconstruction by one of the authors (Holland, 2018), this followed a lobby campaign with meetings and email exchanges with officials of the European Commission engaged in numerous services. The ERF organised events and had high-level access to at least three EU Presidencies (Malta, The Netherlands and Bulgaria). At the start of its EU Presidency in the first half of 2016, the Dutch government organised a high-level conference on the issue, in collaboration with BusinessEurope. At the initiative of the Dutch Presidency, the innovation principle was endorsed in the conclusions of the Competitive Council meeting held in May 2016.

Following that endorsement by the Council, the European Commission (Directorate General for Research and Innovation) set up an ‘Innovation Principle Taskforce’. In 2018, this Directorate General’s management plan included the screening of future policy and legislative initiatives “to identify those where the innovation principle could be implemented (European Commission, 2018b).”

DG Research and Innovation encouraged further dialogue among legal scholars on the innovation principle by issuing a Horizon2020 research funding call, titled ‘Taking stock of the application of the precautionary principle in Research & Innovation’. The framing of the problem in the call is telling: “the application of the precautionary principle has become controversial, with some stakeholders advocating an Innovation Principle”. The funding call asked consortia to help find “a balanced approach” between the two, and to “develop new tools or approaches” for both (European Commission, 2017).

Major political controversy arose in autumn 2018, when the innovation principle appeared in the preamble to the new Horizon Europe regulation, governing the new five-year €100 billion research funding. Over one third of the Members of the European Parliament voting on this regulation on 12 December 2018 supported an amendment proposing to delete the reference to the innovation principle.

What are the main implications of the innovation principle? As highlighted by legal experts who published a critical paper on it, a key issue is that the term ‘innovation’ in innovation principle is not qualified (Garnett et al., 2018). Innovation as a general term is neither positive nor negative. A non-defined innovation principle can promote innovations that can be regarded as harmful or beneficial, which is also dependent on the set of values adhered to.

Documents obtained via a FOI request to the European Commission indicate that the industry architects of the innovation principle actually aim to challenge EU chemicals regulation (REACH) as well as EU rules for novel foods, pesticides, nano-materials, pharmaceuticals, medical devices and biotechnologies, so as to achieve what industry calls “supportive regulations” (Holland, 2018).

While the ERF and the European Commission have indeed repeatedly stated that the Precautionary Principle would only be “complemented” and not undermined by the innovation principle, in the past the ERF has criticised the precautionary principle for being “inconsistent with scientific approaches to policy-making” and for “not sufficiently taking account of economic efficiency” (Smith et al., 2010). Interestingly, in January 2021 the ERF changed its name into European Regulation and Innovation Forum (ERIF) (European Risk Forum, 2020).

While the European Commission appears aware of the benefits brought about by the Precautionary Principle (European Commission, 2018a), and of the innovative effects of regulating harmful products so that better ones can be produced (Tuncak, 2013), the evidence obtained by Holland (2018) suggests a convergence of narratives between the European Commission and the industrial interests behind the innovation principle.

5. Discussion

The cases proposed show that forms of cultural capture linked to science as a source of evidence for policy-making have become a fertile ground for corporate penetration, leading to actions targeting different aspects of science for the policy system. Note that we use the term *cultural* here, to encompass intellectual, ideological, or political forms of dominance. The phenomena of dominance of private interest on political life – up to the capture of political parties, are amply documented (Foerstel, 2009). Also the subjugation of science to private agendas is the subject of an extensive literature (McGarity & Wagner, 2012). We try to delineate here a new and relatively recent frontier of this process of domination.

What conditions have made it possible for the frontier of regulatory capture to move so fast and get so far? For some (Foucart et al., 2020), this is due precisely to the social and academic reaction to the practices of the merchants of doubts. When these practices have

⁷ Tobacco industry lobbying has become increasingly controversial, and is restricted by the WHO Framework Convention on Tobacco Control, which includes an article (5.3) that aims to strongly reduce opportunities for tobacco lobbyists to meet with public officials.

been exposed for what they were in the literature and in the media (Michaels, 2008, Oreskes & Conway, 2011), corporate systems adapted by changing strategy (Foucart et al., 2020). We suggest two additional factors driving lobbyists' success:

- 8 A favourable cultural and political climate, where a worldview – which some call neoliberal⁸ and others 'cosmopolitan or liberal or classical liberalism' (Pinker, 2018) – claims for itself the control and the authority of science; in this climate those who doubt some aspects of technology, such as the safety of neonicotinoids, the desirability of nuclear energy or of genetically modified products (GMO), can be labelled as enemies of science or victims of 'cultural pessimism' (Pinker, 2018).
- 9 The availability of new powerful instruments such as the use of AI and algorithms in combination with cognitive psychology and the new social media to influence not only the behaviour of consumers (Zuboff, 2019), but what a society considers acceptable and desirable (Amoore, 2020), colonizing spaces of existence, of social, affective and private life hitherto outside the reach of the market (Coudry & Mejias, 2019). This includes targeting with increasing precision a constituency committed to 'defending science' along corporate lines (Foucart et al., 2020). To the existing lists of professional profiles serving corporate interest – from scientists to lawyers, one now needs to add data scientists, cognitive psychologists, trolls and experts in bot technologies, to realize what Foucart et al. (2020) call "The trollization of public space".

The coupling of AI with cognitive psychology allows more and more targets to be reached with less effort. While the new world ruled by AI is normally studied in relation to the control of the consumers in platform-capitalism or surveillance-capitalism (Zuboff, 2019) or in relation to the dangers it poses to the fabric of society and its legal and democratic institutions (Supiot, 2007), the use of AI with cognitive psychology is now also present in regulatory capture⁹ (Foucart et al., 2020).

5.1. An epistemic ladder for regulatory capture

While regulatory capture, as literature taught us, is a process by which interest groups play a role in the formation of public policy (Laffont & Tirole, 1993), we are observing a new form of regulatory capture that is accomplished and sustained by gaining control of the evidence deemed necessary and sufficient, and of the personnel and institutions that review the evidence. We then observe control being established over the image and rhetoric of 'science', the way ethics is called in, all the way to the establishment of an ethic-political order ruled by 'principles'.

Following the traditional regulatory capture theory, Laffont and Tirole (1993) look at 'capture' using the agency approach and the role of informational asymmetries, which they consider as the main rationale to regulatory capture.

In the absence of such asymmetries, regulated firms would be unable to extract rents and therefore would have no incentive to influence regulatory outcomes.

While Laffont and Tirole focus on the attempts at capturing the supervisory decision-making through "collusive activities", we claim that this process has gone under a substantial revision during the last decade, neutralizing and substituting the agency relationship. This process has been made possible via a two-pronged action of penetration.

The first prong is a substitution of collusive activities, by removing the traditional separation between regulators and regulated. This process is built on 'institutional carriers' such as official statements and normative and ethical principles, stated by documents agreed upon by different stakeholders. This allows for a formally neutral and legitimate conduit of industrial interests¹⁰.

Built on the above substitution, the second prong is a process of reframing and rescaling values and the vision of the relationship among science, society and politics.

The agenda of this second prong is to operate a process of cultural capture (Section 2.1), where what is captured and reframed are values at the science-policy interface.

We call this an 'epistemic ladder' (Table 2) in relation to what use is made of science. Thus, the strategy of organized lobbying evolves following stages such as:

- a) Contesting the evidence or influencing the methods whereby the evidence is produced. We call this the epistemic strategy;
- b) Delegitimising or appropriating the role of the institutional settings which produces the evidence. We call this the institutional strategy;
- c) Changing the framework or the worldview, to the effect of removing those elements of regulation and evidence which are seen as undesirable by the private interests. We call this the political strategy.

This three-partite classification under the heading of epistemic, institutional and political strategy is of course a rough simplification. *Sensu lato*, all steps are political.

⁸ Several authors especially in the US point to how a form of ideology identified as neoliberal has been inculcated in society by a well-funded array of think tanks, see e.g. (Lakoff, 2008; Mirowski, 2019).

⁹ The literature on the impact of algorithms on the various aspects of society cannot be reviewed here, yet scholars of different formation, e.g. from philosophers to jurists, from data scientists to historians, reviewed in (Saltelli & Di Fiore, 2020), agree that algorithms contribute to create what Luise Amoore calls a new "ethicopolitical arrangement of values" (Amoore, 2020).

¹⁰ An anonymous reviewer of a previous version of the manuscript observed that what is being described here under regulatory capture could be construed as a case of 'complex private networked governance'.

The ascension of the ladder consolidates a dominant position of private interests in the science-policy interface due to information asymmetry (Section 4) and resource availability. Instead of aiming merely to rent seeking, this process leads to industry capturing society, not just regulators. This goes beyond the known issue of public money being spent to produce knowledge that becomes the property of corporations (Krimsky, 2003), but amounts to a capture of what Sheila Jasanoff call ‘sociotechnical imaginary’, intended as how visions of scientific and technological progress carry with them implicit ideas about public purposes, collective futures, and the common good (Jasanoff & Kim, 2015; Konrad & Böhle, 2019). For Jasanoff sociotechnical imaginaries – when compared to deterministic visions of technology, with their lock-ins and path dependencies, allow for a more open sense of agency and contingency in society’s charting of technological possibilities. Sociotechnical imaginaries are co-produced, and:

It often falls to legislatures, courts, the media, or other institutions of power to elevate some imagined futures above others, according them a dominant position for policy purposes. (Jasanoff & Kim, 2015), p. 4.

In our work, we follow (Mirowski, 2020) in his critique of Jasanoff in noting that not all actors are equal when it comes to co-producing, and that corporate powers appear to have mastered the game of production of sociotechnical imaginaries better than any other social actor.

To make an example, one may speculate that if there were one day an institution appointed to ‘fix’ the crisis in science’s quality control practice (Saltelli & Funtowicz, 2017) - possibly promoted by well-meaning people - lobbyists would quickly infiltrate it. Perhaps this has happened already, in a temple of supposedly good science, with the major crisis investing Cochrane¹¹ (Greenhalgh, Ozbilgin, Prainsack, & Shaw., 2019).

Going back to our epistemic ladder, the case studies allow to highlight these key emerging features (Table 2).

- Invalidating the inference or influencing the methods whereby the evidence is produced – the play of the ‘Merchants of Doubt’

The neonicotinoids case shows how the corporate strategy is to influence the field of methodology, whereby evidence is produced. Pesticides regulation is defined by Olivia Hamlyn (Hamlyn, 2019) as a highly complex, polycentric and decentred, multi-actor, transnational risk regulation regime, where uneven levels of transparency exist between the procedures for the approval of an active component (e.g. a given neonicotinoid molecule) and the authorization of a multi-ingredient (active substances, safeners, synergists and co-formulants) pesticide. Due to this multi-stakeholder process, all potentially have the opportunity for strategic behaviour, but in this, as in other contexts, power and knowledge asymmetries risk favouring the stakeholders with the largest ability to mobilize human and financial resources. The appeal of tobacco companies to ‘sound science’ or ‘sound epidemiology’ is a strategy aimed to compete in the scientific field by weakening its authority. Of note, industry plays the evidence-based regulation game with its own laboratories, journals, law firms, think tanks (Heath, 2016, Foucart et al., 2020), and it uses its own data strategically, including recourse to the law to protect the disclosure or reuse evidence produced in its own laboratories (Millstone, Brunner, & White, 1994).

Recalling Zuboff’s word (Zuboff, 2019), this *instrumentarian* strategy to sound-science approach also reveals an institutional and political vulnerability of the regulation architecture, as explained above (First case).

- Delegitimising or taking the role of the institutional settings which produces the evidence or otherwise ‘colonising’ it

The cases of the *EU Science Advice Mechanism* show how crucial instances of production of evidence for policy-making are (or are made) vulnerable to corporate influence.

By asking to “further institutionalize the role of scientific evidence in the political process” (Marcegaglia, 2014), the lobby group suggested to create a whole new bureaucracy within the European Commission, with individual CSAs in each DG of the European Commission, to control “the collection and use of scientific advice”, “based on a formal process of evidence gathering, including strict scientific standards”.

This new bureaucracy would also see its mandate expanded to try to streamline the scientific advice provided to decision-makers by the various scientific institutions among Member States and EU institutions, and even strengthen the “relationships to science expertise in other regions, particularly the USA”.

The *Ethics washing in artificial intelligence* is a further step of colonising *institutional settings* which shows the reach and speed of corporate action. A rhetorical use of ethics in the statement is a powerful strategy to contrast the image of lobbyists as upholders of a ‘special interest’ and to integrate them among the guardians of the ‘public interest’ of science.

The *Brussels Declaration* illustrates a novel practice of colonization instances where science and its uses are created. Thanks to the sophisticated strategy leading to the declaration, the tobacco lobby managed to circumvent the Framework Convention on Tobacco Control (FCTC), which precludes the tobacco industry and related vested interests from having any input into public health policy.

Even the calls for ‘bottom up’ effort, as described in the preamble of the Brussels Declaration, is instrumental. Lobbyists can instigate grassroots efforts known as ‘astroturfing’ – the practice whereby corporate positions are made to appear as originating from the bottom and as responding to a societal demand; along these lines is the mobilization of the “Guardians of reasons” discussed above (Foucart et al., 2020).

¹¹ Founded in 1993, the Cochrane Collaboration is an international non-profit initiative created to spread worldwide the goals of evidence-based medicine. We refer here to the case of the expulsion in 2018 of Peter Gøtzsche, a key exponent of Cochrane. The expulsion gave rise to an intense controversy and exchange of accusations (Greenhalgh et al., 2019; Ioannidis, 2019). The episode may suggest the danger that even those institutions which were created with the express agenda to protect citizens against industrial power (such the pharma sector) may become a privileged target for corporate pressure, and how this may be facilitated by the these bodies’ institutional mandate to interface with the industrial sector. See also an interview with David Sackett (Ioannidis, 2016), a pioneer of evidence-based medicine, where finance-based medicine is discussed.

- Changing the framework or the worldview in the context of which the evidence – or the very idea of regulation – are relevant or desirable.

The *innovation principle* is a step based on which the corporate level moves from the level of declarations to that of principles: with the innovation principle lobbyists attempt to change the framework or the worldview in the context of which regulatory processes take place. By creating a new layer of impact assessment, it offers industry a platform to demonstrate how certain new or revised regulations may affect the economic success of a product or technology. The innovation principle is not an established principle of law, like the precautionary principle or the polluter pays principle. It is a tool designed to create more leverage for business interests in the early phase of decision making (Holland, 2018); it can be considered as a transversal, cross-cutting tool for industry to counter evidence of risk or harm, as well as evidence of safer alternatives¹². To be noted that, by targeting principles, lobbyists appear to have well read the work of Braithwaite and Drahos (2000), whose main thesis is that “Principles serve as the infrastructure of global regulation - they pattern the complex regulatory superstructures that follow them”, p.9.

The stages described above can of course superimpose or ‘talk’ to one another, so that the Brussels Declaration, which we labelled under institutional strategy, paves the way to the innovation principle, an instance of political strategy. The cases of ethics washing and the EU science advice mechanism both include elements of epistemology and policy.

These relations are captured by ascending steps, from the invalidating evidence, to bureaucratic expertise, up to the rhetorical function of science; finally, the principle of innovation, competing with the precautionary principle in the interface between politics and science, candidates itself as a standard of political actions. In fact, as observed by Surel (2000), “the asymmetry in resources and positions” of a “particular category of actors” enables them to play “the role of mediator or policy-broker”, translating their “structure of interests” into a new cognitive and normative framework that competes with the existent multiple one. This interplay in policy-making explains the dynamics beneath the policy change.

5.2. The vulnerable future of science

The five cases show how science has been mobilized at the service of a new regulatory capture landscape. The guardians of reason deploy the strategy of depicting it as a victim of the forces of reaction and of ‘fake news’. Our cases appear to suggest instead that science would need to be defended from itself (Saltelli, 2019), in line with sociologist Ulrich Beck’s old remark about science as a self-service shop for financially well-endowed customers in need of arguments (Beck, 1992). The relation between corporate interests and science can be seen as a dynamic game of reciprocal domestication (Saltelli & Boulanger, 2019).

The double vulnerability of science and of regulators explains why a sophisticated form of corporate pressure would target the locus where science and the regulation system interact.

One of the points of strength of corporate lobbying is that it is not bound by a unitary vision of the role of science in society: so when science is used by regulators, it must be shown to be confusing, opaque and non-reproducible (Saltelli, 2018); when serving the corporate interests, science must instead be presented as a privileged or a unique way of deciding human affairs¹³. Here is where an instrumental appeal to the values of the Enlightenment (Pinker, 2018) becomes helpful. To see this worldview in action, we can simply go back to the Brussels Declaration:

If as a society we recognise the benefits of increasing scientific input at all stages of the policy-making process, then we must all redouble our efforts to remove the political barriers that prevent science being heard.

... science must enhance its voice, be courageous in policy debates, and get better organised to ‘gang up’ and ensure more accurate representation of its findings. (World Science Forum, 2017)

This language of vigorous (Promethean) advocacy, in the same paragraph where scientists are told to be less aloof and arrogant, serves the function of enrolling science on the side of corporate interests when they, to make an example, defend the development and commercialization of GMOs against the ‘political’ opposition of EU member states and citizens.

One vision of the alliance between scientism and corporate interest is that of a “science-based authoritarian populism” (Van Dyck & Arora, 2018), whose elements can be identified as

- 1) A simplification of the political discourses between the poles of ‘scientific evidence’ and ‘public opinion’, used to disqualify the latter as unscientific.
- 2) Identification of the idea of progress with scientific progress.
- 3) An exculpation of science (and technology) for its responsibility in present problems and possible oncoming dystopias.

This is achieved by blending all different aspects of today’s science into a single unitarian Science:

Overall, the unification of disparate sciences as Science, we argue, is part of an array of mutually-reinforcing tactics deployed by alliances between specific scientists, policymakers and sections of the public to silence dissent and marginalise difference. This is what we term Science-based authoritarian populism. (Van Dyck & Arora, 2018)

¹² The change in the name of the European Risk Forum into European Regulation and Innovation Forum matches the theses of the present work of a movement from the epistemological to the institutional and political spheres.

¹³ There is indeed here an element of radical techno-optimism, whereby not only is society the recipient of the wonders of science and technology, which can hardly be contested, but the act of doubting is a sign of defeatism and pessimism, as argued in the work cited (Pinker, 2018).

Resisting these corporate manoeuvres, while saving science and its use in the design, implementation and evaluation of policy, is fraught with difficulties, given the existing power asymmetries. Yet this resistance is needed in order not to abandon science's desirable qualities in the hands of the most powerful. If this were to pass, one would have achieved a 'techno-split' scenario (Lent, 2017), with an affluent and possibly transhuman (Harari, 2016) minority funding its own brand of science, and a majority descending the social ladder, left glued to its mobiles and tablets (Editor, 2018).

6. Conclusions – the epistemic ladder as cultural capture

Powerful, international, and interconnected actors can create the sociotechnical imaginaries (Jasanoff & Kim, 2015) that are functional to 'vested interests' (Veblen, 1919). It is in this context that we introduce our concept of epistemic ladder. As noted by an anonymous reviewer, the concept of regulatory capture somewhat underplays the domination by capital of science, and may point instead "to something deeper, perhaps Heidegger's notion of 'enframing'".

Over the last decade, private interests have significantly perfected and upgraded science-based forms of societal pressure and control. As discussed via examples here, Europe offers clear examples of colonization of the world of science by corporate lobby. However, this penetration did not follow the *traditional* regulatory capture. Instead, it could be depicted as a complex and nonlinear strategy, spanning epistemic, institutional, and political dimensions, where science plays a predominant role. New agency relationships, knowledge and power asymmetry are elements of this new landscape. Such an asymmetry in the use of knowledge¹⁴ needs rebalancing.¹⁵ The colonization of the science-policy nexus has been a historic objective of private interests, what we call institutional strategy¹⁶. For this reason, in Europe, especially those organizations which need a constant interlocution with the industrial sector as part of their remit, as for example the European Commission, and all regulatory agencies, should be especially vigilant. Their credibility and legitimacy also hinge upon how they react to the political strategy of interest groups.

The present stage of this project of domination, which we have indicated as the culmination of the epistemic ladder, is that of capturing and consolidating the current sociotechnical imaginary (Jasanoff & Kim, 2015), one where a radically optimistic vision of science and technology in its capacity to produce universal progress and well-being (Bastani, 2019; McAfee & Brynjolfsson, 2017; Pinker, 2018), when not a superior form of humanity (Harari, 2016), is functionally coupled with intellectual economic forces which propose a market-centric vision of the world, as noted by Lakoff (2008) and Mirowski (2019). The union of capital and science (Conner, 2005) is thus moving on to conquer the new apparently endless frontier of data exploitation colonizing areas of our life, relationships, communications, and commodifying private life (Coudry & Mejias, 2019). It is in this favourable climate that grassroots movements such as that of the guardians of reasons can be mobilized. It is not easy here to propose effective strategies of contrast, other than the rather generic call for a mobilization of all forces of society which are seen in works addressing the present situation, see e.g. (Zuboff, 2019). For the reasons given in the present work, we suspect that forms of societal pressure will be more effective if addressed – for a start - to the political economy of how science is organized in our modern societies (Mirowski, 2020). But this is a still unwritten project.

References

- Amore, L. (2020). *Cloud ethics, algorithms and the attributes of ourselves and others*. Duke University Press. <https://www.dukeupress.edu/cloud-ethics>.
- Anon. (2017). *Stop glyphosate*. Retrieved October 24, 2020. European Citizens' Initiative (ECI) <https://stopglyphosate.org/en/>.
- Bastani, A. (2019). *Fully automated luxury capitalism. A manifesto*. New York: Verso.
- Beck, P. U. (1992). *Risk society: Towards a new modernity*. CA: Sage Publications.
- Bernstein, M. H. (1955). *Regulating business by independent commission*. Princeton University Press.
- Bero, L. (2018). Ten tips for spotting industry involvement in science policy. *Tobacco Control*, 28(1), 1–2. <https://doi.org/10.1136/tobaccocontrol-2018-054386>
- Böttcher, C. (2016). Cut red tape to help innovation boom, says German chemistry Sector. *Chemistry world*.
- Braithwaite, J., & Drahos, P. (2000). *Global business regulation*. Cambridge University Press.
- Brooks, C. (2015). Confusion over EU chief scientific adviser role. *The Press and Journal*. January 15.
- BusinessEurope. (2016). *Impact of EU regulation on innovation - Repository of industry cases examples by BusinessEurope, ERT and ERF*. Retrieved March 1, 2020. <https://www.bussinesseurope.eu/publications/impact-eu-regulation-innovation-repository-industry-cases-examples-bussinesseurope-ert>.
- Chubin, D. E. (2001). Filling the policy vacuum created by OTA's demise. *Issues in Science and Technology*, XVII(2).
- Conner, C. D. (2005). A people's history of science: Miners, midwives, and low mechanics. *Nation Books*.
- Corporate Europe Observatory. (2014). EFSA's director thinks juncker does not need a chief scientific adviser. *Corporate Europe Observatory*. Retrieved February 25, 2020 <https://corporateeurope.org/en/power-lobbies/2014/12/efsas-director-thinks-juncker-does-not-need-chief-scientific-adviser>.
- Coudry, N., & Mejias, U. A. (2019). Data colonialism: Rethinking big data's relation to the contemporary subject. *Television & New Media*, 20(4), 336–349. <https://doi.org/10.1177/1527476418796632>
- Crowe, B. L. (1969). The tragedy of the commons revisited. *Science*, 166(3909), 1103–1107.
- Dal Bó, E. (2006). Regulatory capture: A review. *Oxford Review of Economic Policy*, 22, 203–225. <https://doi.org/10.1093/oxrep/grj013>

¹⁴ As discussed in (Saltelli, 2018), "...actors with the deepest pockets can buy the science they need, frame issues according to specific agendas and enforce these on the rest of society."

¹⁵ For Lee Drutman (Drutman, 2015) rebalancing the knowledge asymmetry could take the form of an office for Public Lobbying, offered to citizens on the same rationale whereby indigent defendants are provided with legal counsel by the courts.

¹⁶ In the US, the suppression of the Office for Technological Assessment (OTA) operated in 1995 by the conservatives eliminated the sole body whose "constituency was the citizenry—not just the experts in academe, industry, or the think tanks" (Chubin, 2001).

¹⁷ *The major source of such revelation [industry-sponsored scientific transgression] is an occupational group that would not ordinarily be thought of as deserving mention in a history of science: investigative journalists. It is they who have most frequently and most successfully exposed the pervasive conflicts of interest that have undermined the integrity of modern science* (Conner, 2005), p. 477.

- Drahoš, P. (2020). Responsive science. *Annual Review of Law and Social Science*, 16(1). <https://doi.org/10.1146/annurev-lawsocsci-040220-065454>. annurev-lawsocsci-040220-065454.
- Drutman, L. (2015). *The business of America is lobbying: How corporations became politicized and politics became more corporate*. Oxford University Press.
- Editor. (2018). As inequality grows, so does the political influence of the rich. *The Economist*, (July 21st).
- European Commission. (2012). *Freedom of information*. Retrieved October 25, 2020 https://ec.europa.eu/info/about-european-commission/service-standards-and-principles/transparency/freedom-information_en.
- European Commission. (2017). *European Commission, Research Funding Call, 'Taking stock of the application of the precautionary principle in R&I*. Retrieved <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/swafs-18-2018>.
- European Commission. (2018a). *Assessing the impacts of EU regulatory barriers on innovation*. Retrieved <https://op.europa.eu/en/publication-detail/-/publication/076b7f4b-f1cb-11e7-9749-01aa75ed71a1/language-en>.
- European Commission. (2018b). *Management Plan 2018*. Retrieved. European Commission https://ec.europa.eu/info/sites/info/files/management-plan-rtd-2018_en.pdf.
- European Environment Agency. (2002). In B. Wynne, A. Stirling, S. Guedes Vaz, D. Gee, M. MacGarvin, & J. Keys (Eds.), *Late lessons from early warnings: The precautionary principle 1896-2000*. EEA.
- European Environment Agency. (2013). *Late lessons from early warnings: Science, precaution, innovation*. EEA.
- European Risk Forum -. (2020). (2020). *Excellence in regulatory risk management*. Retrieved November 25 <https://www.eriforum.eu/>.
- Foerstel, H. (2009). *Toxic mix? A handbook of science and politics*. Greenwood.
- Foucort, S., Horel, S., & Laurens, S. (2020). *Les Gardiens de La Raison. Enquête Sur La Désinformation Scientifique*. Éditions La Découverte.
- Garnett, K., Van Calster, G., & Reins, L. (2018). Towards an innovation principle: An industry trump or shortening the odds on environmental protection? *Law, Innovation and Technology*, 10(1), 1–14. <https://doi.org/10.1080/17579961.2018.1455023>
- Glover, A. (2010). *The chief scientific adviser to the president of the European Commission: Role and mandate, presentation*. Archives of the 2010-2014 European Commission. Retrieved https://ec.europa.eu/archives/commission_2010-2014/president/chief-scientific-adviser/documents/csa_standard_slide_set_v3.pdf.
- Glover, A. (2015). Anne Glover on Brussels: A moment of magic realism in the European Commission. *The Guardian*, (February 5).
- Gray, J. (2018). *Unenlightened thinking: Steven Pinker's embarrassing new book is a feeble sermon for rattled liberals*. New Statesman. February.
- Greenhalgh, T., Ozbilgin, M. F., Prainsack, B., & Shaw, S. (2019). Moral entrepreneurship, the power-knowledge nexus, and the cochrane 'Crisis'. *Journal of Evaluation in Clinical Practice*, 25(5), 717–725. <https://doi.org/10.1111/jep.13124>
- Group of Chief Scientific Advisors - Scientific Advice Mechanism (SAM) - European Commission. (2019). *Scientific Advice to European Policy in a Complex World*. Brussels.
- Hamlyn, O. (2019). Shadow zones: Transparency and pesticides Regulation in the European Union. *Cambridge Yearbook of European legal studies* (pp. 1–30). <https://doi.org/10.1017/cel.2019.15>
- Harari, Y. N. (2016). *Homo Deus: A brief history of tomorrow*. Harvill Secker.
- Heath, D. (2016). *Meet the 'Rented white coats' who defend toxic chemicals*. The Center for Public Integrity.
- High-Level Expert Group on Artificial Intelligence. (2019). *Ethics guidelines for trustworthy AI*. Retrieved. European Commission Document <https://ec.europa.eu/futurium/en/ai-alliance-consultation>.
- Holland, N. (2018). *The 'Innovation principle' trap*. December 5. Retrieved. Corporate Europe Observatory <https://corporateeurope.org/en/environment/2018/12/innovation-principle-trap>.
- Horton, R. (2017). Offline: Difficult truths about a post-truth world. *Lancet*, 389(10076), 1282.
- Ioannidis, J. P. A. (2019). Cochrane crisis: Secrecy, intolerance and evidence-based values. *European Journal of Clinical Investigation*, 49(3), e13058. <https://doi.org/10.1111/eci.13058>
- Ioannidis, J. P. A. (2016). Evidence-based medicine has been hijacked: A report to David Sackett. *Journal of Clinical Epidemiology*, 73, 82–86. <https://doi.org/10.1016/j.jclinepi.2016.02.012>
- Jasanoff, S., & Kim, S.-H. (2015). *Dreamscapes of modernity: Sociotechnical imaginaries and the fabrication of power*. The University of Chicago Press.
- Kazatchkine, M., Kinderlerer, J., & Gilligan, A. (2017). Twenty-point plan for science policy. *Nature*, 541(7637), 289. <https://doi.org/10.1038/541289a>
- Klüver, H. (2013). *Lobbying in the European Union: Interest groups, lobbying coalitions, and policy change*. Oxford: Oxford University Press.
- Kolko, G. (1965). *Railroads and Regulation: 1877-1916*. Princeton University Press.
- Konrad, K., & Böhle, K. (2019). Socio-technical futures and the governance of innovation processes: An introduction to the special issue. *Futures*, 109, 101–107. <https://doi.org/10.1016/J.FUTURES.2019.03.003>
- Krimsky, S. (2003). *Science in the private interest: Has the lure of profits corrupted biomedical research?* Rowman & Littlefield Publishers.
- Kwak, J. (2013). Cultural capture and the financial crisis. In Daniel Carpenter, & David A. Moss (Eds.), *Preventing Regulatory Capture: Special Interest Influence and How to Limit it* (Vol. 97811070036, pp. 71–98). Cambridge University Press.
- Laffont, J.-J., & Tirole, J. (1993). *A theory of incentives in procurement and regulation*. MIT Press.
- Lakoff, G. (2008). *Don't think of an elephant!: Know your values and frame the debate*. Chelsea Green Publishing.
- Laurens, S. (2017). *Lobbyists and bureaucrats in Brussels: Capitalism's brokers*. Routledge.
- Lent, J. R. (2018). *Steven Pinker's ideas are fatally flawed. These eight graphs show why*. OpenDemocracy. May.
- Lent, J. R. (2017). *The patterning instinct: A cultural history of humanity's search for meaning*. Prometheus Books.
- Levi-Faur, D. (2005). The global diffusion of regulatory capitalism. *The Annals of the American Academy of Political and Social Science*, 598(1), 12–32. <https://doi.org/10.1177/0002716204272371>
- Marcegaglia, E. (2014). *Science, governance and a stronger European Union: A strengthened role for the chief scientific advisor - letter from BusinessEurope president Emma marcegaglia to José manuel barroso*. BusinessEurope. Retrieved (<https://www.business-europe.eu/publications/science-governance-and-stronger-european-union-strengthened-role-chief-scientific>).
- Maxim, L., & van der Sluijs, J. P. (2010). Expert explanations of honeybee losses in areas of extensive agriculture in France: Gaucho® compared with other supposed causal factors. *Environmental Research Letters*, 5(1), 014006. <https://doi.org/10.1088/1748-9326/5/1/014006>
- McAfee, A., & Brynjolfsson, E. (2017). *Machine, platform, crowd: Harnessing our digital future*. New York: W. W. Norton and Company.
- McCambridge, J., Daube, M., & McKee, M. (2018). Brussels declaration: A vehicle for the advancement of tobacco and alcohol industry interests at the Science/Policy interface? *Tobacco Control*, 28, 7–12. <https://doi.org/10.1136/tobaccocontrol-2018-054264>
- McGarity, T. O., & Wagner, W. E. (2012). *Bending science: How special interests corrupt public health research*. Harvard University Press.
- Metzinger, T. (2019). *EU guidelines: Ethics washing made in Europe - Politik - Tagesspiegel*. Der Tagesspiegel. April 8.
- Michaels, D. (2008). *Doubt is their product: How industry's assault on science threatens your health*. Oxford University Press.
- Millstone, E., Brunner, E., & White, I. (1994). Plagiarism or Protecting Public Health? *Nature*, 371(6499), 647–648. <https://doi.org/10.1038/371647a0>
- Mirowski, P. (2011). *Science-mart, privatizing American science*. Cambridge, MA: Harvard University Press.
- Mirowski, P. (2019). Hell is truth seen too late. *Boundary 2*, 46(1), 1–53. <https://doi.org/10.1215/01903659-7271327>
- Mirowski, P. (2020). *Democracy, expertise and the post-truth era: An inquiry into the contemporary politics of STS*. Academia.Eu. April.
- Mitnick, B. M. (2011). Capturing 'Capture': Definition and mechanisms. *Handbook on the politics of regulation* (pp. 34–49). Edward Elgar.
- Monbiot, G. (2017). Insectageddon: Farming is more catastrophic than climate breakdown. *The Guardian*, (October 20).
- Neslen, A. (2017). Monsanto banned from European parliament. *The Guardian*, (September), 28.
- Ong, E. K., & Glantz, S. A. (2001). Constructing sound science; and 'Good epidemiology': Tobacco, lawyers, and public relations firms. *American Journal of Public Health*, 91(11), 1749–1757. <https://doi.org/10.2105/ajph.91.11.1749>
- Oreskes, N., & Conway, E. M. (2011). *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming*. Bloomsbury Publishing.

- Owen, B. M., & Braeutigam, R. (1978). *The regulation game: Strategic use of the administrative process*. Cambridge: Ballinger Press.
- Pinker, S. (2018). *Enlightenment now: The case for reason, science, humanism, and progress*. Random House.
- Ravetz, J. R. (2011). Postnormal science and the maturing of the structural contradictions of modern European science. *Futures*, 43(2), 142–148.
- Robinson, C., Clausing, P., Cavoski, A., Roger, A., Bernard, A., Whaley, P., Mesnage, R., Portier, C. J., Millstone, E., Demeneix, B., Belpoggi, F., Antoniou, M., Burtcher, H., Stamati, P. N., Cingotti, N., Perroud, S., Pigeon, M., Holland, N., Veillerette, F., Santos, T., Apoteker, A., Muilerman, H., Dermine, M., & Lyssimachou, A. (2018). Ensuring a Higher level of protection from pesticides in Europe: The problems with current pesticide risk assessment procedures in the EU - And proposed solutions. *A white paper prepared for the coalition citizens for science in pesticide regulation*. <https://doi.org/10.5281/ZENODO.2543743>
- Sabatier, P. (1975). Social movements and regulatory agencies: Toward a more adequate-and less pessimistic-theory of 'Clientele Capture'. *Policy Sciences*, 6(3), 301–342. <https://doi.org/10.1007/BF00139972>
- Saltelli, A. (2018). Why science's crisis should not become a political battling ground. *Futures*, 104, 85–90.
- Saltelli, A. (2019). Save science from itself, in Moedas, C., vernos, L., Kuster, S., Nowotny, H., Saltelli, A., Mungiu-Pippidi, A., Wouter Vasbinder, A., Brooks, D.R., Cunningham, P., 2019. 'Views from a continent in flux.' *nature* 569: 481–84. *Nature*, 569, 483.
- Saltelli, A., & Boulanger, P.-M. (2019). Technoscience, policy and the new media. Nexus or Vortex? *Futures*, 115, 102491. <https://doi.org/10.1016/J.FUTURES.2019.102491>
- Saltelli, A., & Di Fiore, M. (2020). From sociology of quantification to ethics of quantification. *Humanities and Social Sciences Communications*, 7–69.
- Saltelli, A., & Funtowicz, S. (2017). What is science's crisis really about? *Futures*, 91, 5–11.
- Saltelli, A., Benini, L., Funtowicz, S., Giampietro, M., Kaiser, M., Reinert, E. S., et al. (2020). The technique is never neutral. How methodological choices condition the generation of narratives for sustainability. *Environmental Science & Policy*, 106, 87–98.
- Smith, K. E., Fooks, G., Collin, J., Weishaar, H., Mandal, S., & Gilmore, A. B. (2010). Working the system'—British American tobacco's influence on the European union treaty and its implications for policy: An analysis of internal tobacco industry documents. edited by E. Smith *PLoS Medicine*, 7(1), e1000202. <https://doi.org/10.1371/journal.pmed.1000202>.
- Stigler, G. J. (1971). The theory of economic regulation. *The Bell Journal of Economics and Management Science*, 2(1), 3. <https://doi.org/10.2307/3003160>
- Supiot, A. (2007). *Governance by numbers: The making of a legal model of allegiance*. Oxford University Press.
- Surel, Y. (2000). The role of cognitive and normative frames in policy-making. *Journal of European Public Policy*, 7(4), 495–512. <https://doi.org/10.1080/13501760050165334>
- Toulmin, S. E. (1992). *Cosmopolis: The hidden agenda of modernity*. Chicago: University of Chicago Press.
- Tuncak, B. (2013). *Driving innovation: How stronger laws help bring safer chemicals to market*. Retrieved. The Centre for International Environmental Law <https://www.ciel.org/reports/driving-innovation-how-stronger-laws-help-bring-safer-chemicals-to-market-full-version-see-also-executive-summary-resume-en-francais-tuncak-february-2013-2/>.
- van der Sluijs, J. P., Simon-Delso, N., Goulson, D., Maxim, L., Bonmatin, J.-M., & Belzunces, L. P. (2013). Neonicotinoids, bee disorders and the sustainability of pollinator services. *Current Opinion in Environmental Sustainability*, 5(3–4), 293–305. <https://doi.org/10.1016/J.COSUST.2013.05.007>
- Van Dyck, B., & Arora, S. (2018). Tactical alliances: Science-based authoritarian populism. In *ERPI 2018 International Conference Authoritarian Populism and the Rural World. International Institute of Social Studies (ISS) in The Hague*.
- van Zwanenberg, P. (2020). The unravelling of technocratic orthodoxy. In I. Scoones, & A. Stirling (Eds.), *The politics of uncertainty* (pp. 58–72). Routledge.
- Veblen, T. (1919). *The vested interests and the state of the industrial arts*. New York: Huebsch.
- Vogel, G. (2017). Where have all the insects gone? *Science*, (May 10) <https://doi.org/10.1126/science.aal1160>
- Whitehorn, P. R., O'Connor, S., Wackers, F. L., & Goulson, D. (2012). Neonicotinoid pesticide reduces bumble bee colony growth and queen production. *Science (New York, NY)*, 336(6079), 351–352. <https://doi.org/10.1126/science.1215025>
- World Science Forum. (2017). *The brussels declaration on ethics & principles for science & society policy-making*. Retrieved. Euroscientist <http://www.euroscientist.com/wp-content/uploads/2017/02/Brussels-Declaration.pdf>.
- Wynne, B. (2014). Further disorientation in the hall of mirrors. *Public Understanding of Science*, 23(1), 60–70.
- Zuboff, S. (2019). *The age of surveillance capitalism: The fight for a human future at the new frontier of power*. New York: PublicAffairs.