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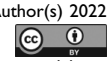

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Abstract
In 2019, the Von der Leyen Commission made a grand entrance announcing an ambitious political agenda, the European Green Deal (EGD), combining its sustainability agenda and meeting environmental challenges with the pursuit of economic growth. In this paper, the author discusses the role of technology in the EGD through the lens of technological determinism. It is argued that, in many ways, the EGD overestimates the importance of technology, especially new technology. Unlike typical technological determinist views, the EGD recognises the importance of human agency. However, the success of human and social agency as drivers change in this project depends on preferences of actors involved in this green transition, including technological preferences. The author argues that the source of these biases lies with the economic policy foundations of the EGD which lead to prioritising economic interest over environmental needs. The article suggests that greater reliance on environmental regulation may restore the appropriate balance between economy and environment, and between the belief in the power of new technology and people's responsibility for the environmental and other consequences of technology production and use, and thus improve the prospects of the EGD in its environmental and sustainability aspirations.

Keywords
European Green Deal, technological determinism, environmental regulation, technology

1. Introduction

In 2019 the Von der Leyen Commission made a grand entrance announcing an ambitious political agenda, the European Green Deal (hereinafter: EGD), with its focus on addressing climate change as the greatest environmental challenge.[1] The President of the Commission celebrated the EGD as 'Europe's hallmark'

1. Political Guidelines for the Next European Commission 2019–2024: A Union that strives for more: My Agenda for Europe, political-guidelines-next-commission_en_0.pdf (europa.eu).

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and 'man on the Moon' moment, which should lead Europe to become the first climate-neutral continent.[2] As its main objective, the Commission recognised a renewed commitment to tackle 'climate and environmental cross-related challenges'.[3] The EGD was also hailed as "a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy".[4] The name deliberately echoes Roosevelt's New Deal, which was a programme of economic development.

The EU's goal is also to ensure that a transition to a 'fair and prosperous society' is just and inclusive, reaching out to regions, industries and workers who will be most affected.[5] The EU recognises its collective ability to transform its economy and society and position itself as a global environmental leader. To that end, the European Commission has put in place a range of policies across different sectors including "economy, industry, production and consumption, large-scale infrastructure, transport, food and agriculture, construction, taxation and social benefits".[6] Green and digital technologies are regarded as key enablers of economic growth in identified policy sectors. They are also regarded as crucial in achieving the objectives of the EGD. These policies are to be implemented by deploying several policy levers, including regulation and standardisation, investment and innovation, national policies, engagement of social partners and enhancing international cooperation.[7]

As technology plays a key role in driving the change, this paper discusses its role in the EGD, through the lens of technological determinism. Technological determinism is the view that technology drives or determines social phenomena, and is typically seen as inappropriately reducing the role of human actors, their agency and responsibility. The issue of technology is particularly pertinent to environmental debates as technology is predominantly regarded as a constituent part of environmental change, often responsible for environmental problems and as the main promise for the solutions to such problems.[8] This discourse maintains that technology will not only drive environmental change but it will also lead to economic growth. This discourse is not only present in the EU but it is widely recognised in many national jurisdictions as best illustrated by the UK Ten Point Plan for the Green Industrial Revolution.[9] To that effect, it becomes relevant to assess the role of technology in this environmental endeavour, as well as to examine the implications of this intersection between technology, economy and the environment for the effectiveness of the EGD.

This paper argues that EGD is underpinned by technological determinism whereby both environmental change and economic progress are driven by technology. This raises questions about the genuine nature of the EGD. Through analysis drawing on technological determinism theory, which is usually employed in the field of political and social science, the paper develops an interdisciplinary approach to the study of the intersection of technology, economy and environmental regulation. Using this perspective to the

2. New Climate pact is EU's 'Man on the Moon Moment': chief executive New climate pact is EU's 'man on the moon moment': chief executive | Reuters; Green Deal branded as 'Hallmark' of New European Commission Green Deal branded as 'hallmark' of new European Commission – EURACTIV.com. See also press remarks by President von der Leyen on the occasion of the adoption of the European Green Deal Communication, President von der Leyen on the European Green Deal (europa.eu).
3. European Green Deal COM(2019) 640 final at 2.
4. Ibid. at 2.
5. Ibid. at 2.
6. Ibid. at 4.
7. Ibid. at 4.
8. See J. Dyke, R. Watson and W. Knorr, 'Climate Scientists: Concept of Net Zero is a Dangerous Trap' (2021) Climate scientists: concept of net zero is a dangerous trap (theconversation.com); See P. Peeters, J. Higham, D. Kutzner, et al., 'Are Technology Myths stalling Aviation Climate Policy?' (2016) 44 *Transportation Research Part D: Transport and Environment* 30–42.
9. See HM Government: The Ten Point Plan for a Green Industrial Revolution: Building Back Better, Supporting Green Jobs, and Accelerating our Path to Net Zero (2020).

examine the EGD demonstrates its relevance beyond the domain of social sciences and application to legal scholarship. This paper further argues that EGD, although conceived as an environmental agenda, is predominantly focused on economic goals while subjecting environmental policy to those goals. This raises concerns about the EU's ambition to create conditions of sustainability and ecosystem health. Unlike more technologically deterministic national policies, the EGD recognises the role of human agency in pursuing policy objectives, which signals a more moderate strand of technological determinism that recognises existence of other drivers of change. However, the engagement of citizens in this project partly depends on technological preferences of actors involved in this green transition, as well as their ability to avail of technologies. This is linked to a wider issue of cycle of technological development with one technology replacing another due to their unintended consequences which may affect the preferences of actors. The unintended consequences can include undesired effects such as economic, environmental and social effects which cannot be always foreseen or easily mitigated. Thus, the paper concludes that environmental regulation should play an important role in harnessing the unintended consequences that technologies may have. This involves different regulatory techniques, including traditional and soft regulatory approaches coupled with robust compliance and enforcement. Only a comprehensive regulatory framework can address urgent environmental problems by recognising at the same time the intrinsic value of the environment.

The paper's structure is as follows. The first part is a brief overview of the theory of technological determinism that provides a useful framework for assessment. The second section then examines the understanding of technology as a key driver of change in the EGD. Finally, the paper analyses the relationship between technology and environmental regulation as a tool to address effects of different technologies.

2. The perspective of technological determinism

Technological determinism explores the role that technology plays in enabling societal progress, including not only technological but also economic or environmental progress. While the original meaning of technology is the study of techniques and practices, over the years the word has come to indicate not only those techniques and practices, but also the resulting artefacts and the tools and skills that are used to produce them.[10] Technology is regularly discussed in the context of science as technology is regarded as body of knowledge steered by science.[11] Still, the recognition of the importance of technology gave rise to the belief that technology in some way determines, defines and characterises a society, often labelled "technological determinism".[12] As Wyatt argues

> "naming whole historical epochs and societies by their dominant technological artefacts…. This way of thinking about the relationship between technology and society has been 'common sense' for so long that it has hardly needed a label. But its critics have termed it 'technological determinism,' which has two parts. The first part is that technological developments take place outside society, independently of social, economic, and political forces. New or improved products or ways of making things arise from the activities of inventors, engineers, and designers following an internal, technical logic that has nothing to do with social relationships. The more crucial second part is that technological change causes or determines social change".[13]

10. E. Schatzberg, 'Technik comes to America: Changing Meanings of Technology before 1930' (2006) 47 Technology and Culture 487–88.
11. See J.D. Peters, ''You Mean My Whole Fallacy Is Wrong': On Technological Determinism' (2017) 140 *Representations* 10–26.
12. B. Bimber, 'Karl Marx and the Three Faces of Technological Determinism' (1990) 20(2) *Social Studies of Science* 333–51.
13. S. Wyatt, 'Technological Determinism is Dead; Long Live Technological Determinism' in E.J. Hackett, O. Amsterdamska, M.E. Lynch and J. Wajcman (eds), *The Handbook of Science and Technology Studies* (MIT Press, 2008) 168.

Kline offers a similar definition of technological determinism as "a term used to describe a set of claims made about the relationship between what we generally call 'technology' and 'society'".[14] He also distinguishes between two meanings of technological determinism – the internal meaning associated with technical logic that "determines the design of technological artefacts and systems"[15] and a more external understanding that examines the impact of technological development on social changes.[16]

Technological determinism is a term often used as a criticism, especially with regards to its broader external denotation.[17] To be a technological determinist is to make unwarranted deductions based on an oversimplified understanding of the relationship between technology and society. Technological determinism proposes that technological change is autonomous and technological development and innovation are primary drivers of change.[18] Other non-technological drivers of change, for example social, economic, legal, cultural or other processes are typically regarded as having marginal effects.[19] This understanding of technological determinism has a long lineage and it is by no means monolithic, encompassing several different strands. The normative strand argues that "society is relinquishing control over technology or replacing political and ethical norms with technological goals".[20] The nomological account of technological determinism argues that "technology develops autonomously to force a prescribed social change".[21] Another form is the unintended consequences account, which assumes that technology produces unpredictable social change and underlines that it may happen that technology becomes out of control.[22]

Related to these different strands of technological determinism is its relationship with human agency. As Dafoe suggests, it becomes important to consider to what extent technological determinism leaves us control over the technology we use.[23] If technological change equals progress[24] and as such determines social change in a prescribed manner,[25] technological determinism becomes divorced from human agency which does not have a role to play in enabling social change. Technology becomes an agent in itself which drives social change without the intervention of individual or collective human agency. However, Wyatt emphasises the danger of equating technology with progress and developing technologies outside social interest.[26] Moreover, determinist views of change limits the room for human intervention[27] and as such reduces the ability of individuals to pursue their interest that will have an effect on social change[28]. Thus, the extent of ensuring the engagement of individuals becomes the key challenge in pursuing the technologically deterministic discourse.

14. R.R. Kline, 'Technological Determinism' in J.D. Wright (ed), *International Encyclopedia of the Social & Behavioral Sciences*, 2nd edition, Volume 24, (Amsterdam, the Netherlands: Elsevier, 2015) 109.
15. See Kline, above n. 14 at 109.
16. Ibid. at 109.
17. See A. Dafoe, 'On Technological Determinism: A Typology, Scope Conditions, and a Mechanism' (2015) 40(6) *Science, Technology, & Human Values* 1047–76.
18. See Dafoe, above n. 17. See Wyatt above n. 13.
19. See more in A. Čavoški, 'Potential Risks for an Electric Vehicle Future' (2019) *e-law*, no. 111, 26–28. https://www.ukela.org/UKELA/ReadingRoom/Elaw-Publications/elawnewsletter.aspx
20. See Kline, above n. 14 at 110.
21. Ibid. at 110.
22. Ibid. at 110
23. See Dafoe, above n. 17 at 1053–1058.
24. See Wyatt, above n. 13 at 168.
25. See Kline, above n. 14 at 109–112.
26. See Wyatt, above n. 13 at 172.
27. Ibid. at 169.
28. See more in J. Battilana, 'Agency and Institutions: The Enabling Role of Individuals' Social Position' (2006) 13(5) *Organization* 653–76.

3. Technological determinism in the European Green Deal

The EGD is a Communication of the Commission, in the tradition of White Papers – a declaration of political intent that announces a series of policy strategies that will follow. In its opening paragraph, it reaffirms the Commission's plans to address major environmental problems such as climate change and environmental pollution. To that end, the Commission deploys different 'transformative policies' that will assist in achieving the ultimate objective of climate neutrality by 2050. The main eight policies are the following: increasing the EU's climate ambition for 2030 and 2050; supplying clean, affordable and secure energy; mobilising industry for a clean and circular economy; building and renovating in a an energy and resource efficient way; accelerating the shift to sustainable and smart mobility; Farm to Fork policy for a fair, healthy and environmentally-friendly food system; preserving and resorting ecosystems and biodiversity and creation of toxic (zero pollution) free environment.

The word technology in its generic form, appears only twice in the EGD, both times under the heading "mobilising research and fostering innovation". The first mention is in the name of the "European Institute of Innovation and Technology"[29] and the second is in a sentence about involving local communities in "working towards a more sustainable future, in initiatives that seek to combine societal pull and technology push"[30]. There are also a small number of direct mentions of specific technologies such as the following:

> "Further decarbonising the energy system is critical to reach climate objectives in 2030 and 2050. The production and use of energy across economic sectors account for more than 75% of the EU's greenhouse gas emissions. Energy efficiency must be prioritised".[31]

> "There is significant potential in global markets for low-emission technologies, sustainable products and services".[32]

> "Digital technologies are a critical enabler for attaining the sustainability goals of the Green deal in many different sectors. The Commission will explore measures to ensure that digital technologies such as artificial intelligence, 5G, cloud and edge computing and the internet of things can accelerate and maximise the impact of policies to deal with climate change and protect the environment".[33]

> "Automated and connected multimodal mobility will play an increasing role, together with smart traffic management systems enabled by digitalisation".[34]

> "The EU should in parallel ramp-up the production and deployment of sustainable alternative transport fuels. By 2025, about 1 million public recharging and refuelling stations will be needed for the 13 million zero- and low-emission vehicles expected on European roads".[35]

> "There are new opportunities for all operators in the food value chain. New technologies and scientific discoveries, combined with increasing public awareness and demand for sustainable food, will benefit all stakeholders".[36]

29. Above n. 3 at 18.
30. Above n. 3 at 18.
31. Above n. 3 at 6.
32. Above n. 3 at 7.
33. Above n. 3 at 9.
34. Above n. 3 at 10.
35. Above n. 3 at 11.
36. Above n. 3 at 11.

Despite these few references, technology occupies a key role: "new technologies, sustainable solutions and disruptive innovation are critical to achieve the objectives of the European Green Deal".[37] The reference to technology as critical can also be found in pledges made by previous presidents of the European Commission. In Barroso's 2009 Political Guidelines, exploiting "the potential of EU environmentally-friendly industries, services and technology" is seen as the best way to deliver first-mover advantages in leading on climate change which was outlined as a second political priority for that Commission.[38] Technology is regarded as 'critical' to allow for transformation of "energy supply in a well-regulated EU internal market".[39]

If we look closely at transformative policies and objectives set out in the EGD, they all rely on different types of technology such as wind energy, clean hydrogen, electric vehicles, carbon capture, storage and utilisation. The overarching EU policy is to increase the EU's climate ambition for 2030 and 2050 by ultimately aiming for 2050 climate neutrality. As stated in the European Climate Law, the aim is to achieve "a balance between anthropogenic economy-wide emissions by sources and removals by sinks of greenhouse gases domestically within the Union by 2050 and, as appropriate, achieve negative emissions".[40] In order to achieve this aim, the Commission recognises that we cannot only rely on natural solutions, such as natural sinks, but we need to explore technological solutions that assist in achieving this overarching objective.[41] A great emphasis is put on digital transformation, technological innovation, and research and development that would act as significant drivers in attaining the climate-neutrality objective.[42]

An obvious example is deployment of renewable technologies which should not just contribute to climate neutrality but also to the second transformative policy of 'supplying clean, affordable and secure energy'. The EGD recognises that the power sector must be developed by predominantly concentrating on renewable sources of energy. This requires the growth of renewable capacity by developing affordable renewable technologies. Increasing offshore wind production is seen as one of the flagship clean energy technologies that will enable this transition. In its Offshore Renewable Energy Strategy, the EU recognises that offshore renewable technologies can make a difference for achieving our climate objectives for 2030 and 2050. [43] To that end, digital technologies are yet again seen as key enablers that will allow for an accelerated development and integration of the offshore energy production into broader energy systems, while at the same time having minimal impact on environment.[44]

This reliance on technology is equally pronounced with regard to other objectives set out in the EGD. With regard to 'mobilising industry for a clean and circular economy', the EGD recognises the importance of access to resources, in particular critical raw materials which are "necessary for clean technologies, digital, space and defence applications".[45] Clean hydrogen, fuel cells and other alternative fuels, energy storage, and carbon capture, storage and utilisation are seen as priority technologies to enable the circular economy model but also contribute to other transformative policies such as "accelerating the shift to

37. Above n. 3 at 18.
38. See the 2009 Political Guidelines for the Next Commission (José Manuel Barroso) at 22 https://ec.europa.eu/commission/presscorner/api/files/document/print/en/ip_09_1272/IP_09_1272_EN.pdf; Microsoft Word - Guidelines_EN.doc (sbe.org.gr).
39. Ibid. at 22.
40. Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') PE/27/2021/REV/1, *OJ L 243, 9.7.2021, p. 1–17 at recital 20.*
41. Ibid. at recital 20.
42. Ibid. at recital 11.
43. COM(2020) 741 final at 1.
44. Ibid. at 2.
45. Above n. 3 at 8.

sustainable and smart mobility". Only with access and deployment of these resources and technologies can this transition happen.

Despite a less obvious link with technology, some other transformative policies in the EGD also rely heavily on technology. With regard to the Farm to Fork Policy, the EGD recognises the importance of 'new technologies and scientific discoveries' that will benefit all stakeholders provided it is coupled with increasing public awareness and demand for sustainable food.[46] Some of those technologies include precision agriculture or artificial intelligence. As technologies are continually developed and refined, the Farm to Fork Strategy emphasises the importance of research, innovation and technology as key drivers in transitioning to sustainable, healthy and inclusive food systems as the principal objective of this EU policy.[47] Finally, an important aspect of creating 'a zero pollution ambition for a toxic-free environment' as another EGD objective is a reduced reliance on harmful chemicals. The Chemicals Strategy for Sustainability enumerates several important roles of technology. Greening and digitalising the production of chemicals as well as novel and cleaner industrial processes and technologies should lower the environmental footprint of chemicals production.[48] The EU has the scientific and technical innovation capacity which will "lead the transition to a safe and sustainable-by-design approach to chemicals".[49]

The importance attributed to technology in the policies of the EGD raises a number of questions that will be further explored. First, it becomes necessary to examine the nexus between technology, economic and environmental objectives and what this tells us about the nature of economic and environmental policy in the European Union. Second, if we argue that the EGD regards technology as one of its key drivers, it becomes necessary to assess if technology is a necessary and sufficient condition for the objectives of the policy to be achieved. This is linked to a much wider question of the role of technology as a proxy of change and its relationship with the role of human agency and how EGD reconciles these two. Indeed, advocating systems innovation and technology to solve environmental problems, undermines human agency and dissolves human responsibility and accountability. Unlike many national environmental agendas, the EGD confirms EU's collective ability to change.[50] This approach seems to indicate a greater alignment with more moderate strands of technological determinism which recognise that other societal factors can be equal drivers of change. Still, technology is not viewed as *primus inter pares* with other drivers of change.[51]

4. Technological determinism and EU environmental policy

As its main objective, the EGD pledges to reset the Commission's commitment to tackling 'climate change and environmental-related challenges'.[52] As discussed earlier, this will be done by implementing a set of transformative policies that will bring benefits to the economy, society and the natural environment. The language of the European Green Deal indicates two important assumptions. First, the EGD is primarily an economic proposition whereby designing these identified policies will enable 'the transformation of the EU's economy for a sustainable future'.[53] To that end, the EGD became a new growth strategy for

46. Above n. 3 at 11.
47. COM(2020) 381 final at 15.
48. COM(2020) 667 final at 7.
49. Ibid. at 4.
50. Above n. 3 at 2.
51. See Peters above n. 11 at 16 about opinions which view technological determinism as equal with other elements which form cultural systems.
52. Above n. 3 at 2.
53. Above n. 3 at 4.

the EU. The primary beneficiaries of this transformational change are EU economies and societies, while the benefits for the natural environment and climate change are secondary to this.[54] Second, technology is regarded as key enabler of change and new technologies followed by sustainable solutions and disruptive innovation are critical to the attainment of the EGD's goals.[55] Technology will not only drive environmental change but it is key to accelerating economic activity and progress and allow transition to "prosperous society, with a modern, resource-efficient and competitive economy".[56]

Framing an environmental agenda as an economic proposition is not surprising and has a long lineage in the European Commission. If we compare the EGD with past pledges made by two previous Commissions, under presidents Juncker and Barroso, the EGD is undoubtedly a more comprehensive and detailed plan that attempts to enable transition and bring change to many different policy areas. This contrasts to the very brief references or no reference to the environment in Barroso's and Juncker's Political Guidelines respectively. Barroso pledged for Europe to lead on climate change while Juncker did not even set a separate priority with regard to environmental protection but only aimed to build a 'Resilient Energy Union with a Forward-Looking Climate Change Policy'.[57] However, in all three political agendas, environmental issues are addressed as a means to creating new jobs and boosting growth and investment. Thus, environmental protection is used instrumentally to create a more prosperous Europe.

This discourse is not only present in the EU but it is widely recognised in many national jurisdictions as best illustrated by the UK Ten Point Plan for a Green Industrial Revolution.[58] Indeed, seven of the ten points in the UK plan focus specifically around the development of particular technologies (1–4, 6–8) with the fifth implying a technological transition element.[59] This theme is not only present in this most recent UK policy document, but represents a further advance in the steady lineage of reliance on technology as a prime driver of social change. A good illustration is the 2017 Industry Strategy which emphasises the enormous opportunities that technologies offer and proposes that the government provides leadership to support the development of these new technologies.[60]

Environmental regulation plays a key role in both attaining economic goals and enabling change through technology in the EGD. Environmental regulation forms part of all transformative policies that should enable "the transformation of the EU's economy for a sustainable future".[61] Moreover, environmental regulation in the EGD is primarily used to regulate technology and through this to affect change. Thus, although the language and discourse are not necessarily strongly technologically deterministic, the technology becomes the primary object of environmental regulation. As discussed earlier, this reliance on technology to bring change also has a long lineage in the European

54. See the EGD, above n. 3 at 23: It supports "the transition of the EU to a fair and prosperous society that responds to the challenges posed by climate change and environmental degradation, improving the quality of life of current and future generations".
55. Above n. 3 at 18.
56. Above n. 3 at 2.
57. See the 2009 Barroso Political guidelines above n. 38 and the 2014 Political Guidelines: A New Start for Europe: My Agenda for Jobs, Growth, Fairness and Democratic Change (Jean-Claude Juncker), Jean-Claude Juncker (europa.eu).
58. See the Ten Point Plan for a Green Industrial Revolution above n. 9.
59. Point 1: Advancing Offshore Wind; Point 2: Driving the Growth of Low Carbon Hydrogen; Point 3: Delivering New and Advanced Nuclear Power; Point 4: Accelerating the Shift to Zero Emission Vehicles; party point 5: Green Public Transport; Point 6: Jet Zero and Green Ships; Point 7: Greener Buildings and Point 8: Investing in Carbon Capture, Usage and Storage.
60. See also the 25 Year Environment Plan which follows the same pattern as the Industry Strategy whereby reliance and use of most emerging technologies is yet again seen as one of the key approaches in "building a cleaner, greener country and reaping the economic rewards of the clean growth revolution". See HM Government: A Green Future: Our 25 Year Plan to Improve the Environment (2018) at p. 4.
61. Above n. 3 at 4.

Commission and featured in political guidelines of several incoming presidents of the European Commission.[62]

In the more comprehensive package of the EGD, environmental regulation is referenced as part of a scheme to incentivise industry to reduce carbon emissions through emissions trading, to incentivise the transition through energy markets, to promote low emission vehicles and transport systems and in relation to construction materials and products. In all those areas, consistently with the focus on economic objectives, regulations will incentivise more environmentally benign technologies and innovations. With regard to transport, the Commission, as one of its main measures, plans to revise legislation on CO_2 emissions performance standards for cars and vans with the aim of proposing "more stringent air pollutant emissions standards for combustion-engine vehicles".[63] The Commission also plans to continue with the deployment of softer regulatory approaches that would strengthen the circular economy by encouraging businesses to offer reusable, durable and more repairable products, including through promoting and regulating eco-friendly designs and technologies. For example, the design of lithium ion batteries can be changed to facilitate their recycling and repurposing.

Soft regulation through the provision of information and advice are also recognised as part and parcel of environmental regulation and they play an equally important role in promoting technologies that will better inform the consumer when making sustainable choices. The Commission recognises digitalisation as one of the ways of improving the "availability of information on the characteristics of products sold in the EU" such as electronic product passports.[64] Consistent with the transition to a more prosperous economy, the EGD seeks ways of directing consumer behaviour and using market demand to direct innovation in more environmentally friendly paths.

This recognition of the significance of traditional policy levers such as regulation and standardisation in the EGD signals an important effort to move beyond purely technological determinism as the underpinning lever of change. This regulatory approach is further coupled with economic and political levers through investment and political dialogue and reform. Still, the extent to which environmental regulation through technology will drive change is dependent on how the regulator addresses the temporal dimension in environmental regulation and its relationship to technology. The main caveat to environmental regulation is the fact that regulation cannot mitigate all unintended consequences that technologies may bring as there will also be unknowns. Put simply, the argument is that developing new technologies and putting them to use throughout the economy takes time. Furthermore, there is always the probability that new technologies will not be as good as we thought, and their use may have unknown unintended consequences. Therefore, if we rely on economic incentives to promote change in a short timeframe, we are taking on huge risks, especially when on the other side of those risks lie environmental catastrophes. Heavy reliance on economic incentives was key to the EU approach to diesel cars when the Commission encouraged Member States to introduce car taxation policies and other fiscal incentives to support this shift to lowcarbon road transport.[65]

62. Similar language is present in Barroso's 2009 Political Guidelines which emphasise critical role of technology, especially low carbon technologies in creating new jobs and new industries and the Commission should take advantage of the potential of research and development on a European scale. The 2009 Barroso Political guidelines above n. 38 at 22: "We have already begun to show that the EU can create new jobs and new industries through low carbon technologies. First-mover advantages can be gained by exploiting the potential of EU environmentally-friendly industries, services and technology through fostering their uptake by enterprises, especially SMEs, and designing the appropriate regulatory environment."
63. Above n. 3 at 11.
64. Above n. 3 at 8.
65. A. Čavoški, 'The Unintended Consequences of EU Law and Policy on Air Pollution' (2017) 26(3) RECIEL 255–265.

Environmental regulation through different regulatory techniques offers more effective tools to address these significant risks.[66] Moreover, deployment of environmental regulation is justified not only by social, technical and political rationales for regulating but plays an important role in cases of market failure.[67] Anderson argues convincingly that strict standards as a form of command and control regulation have an important advantage when it comes to speed and certainty, over soft environmental policies and regulations that rely on market mechanisms.[68] Here we must explain that standards are an element of the EGD and the Commission recognises they have a role to play. However, the EGD discusses standards together with economic incentives and other forms of soft regulation, which differs from Anderson's view of standards.[69] Thig begs the question of whether there should be greater reliance on command and control approach rather than soft regulation and economic incentives. There are three issues of concern here. The first is regulatory capture.[70] Regulatory capture occurs when the relationship between the regulator and the regulatee becomes too close and the regulatee influences policy and standard setting.[71] The overriding concern of the EU with the adaptation costs of its existing industries has a record of leading to processes that underestimate the environmental agenda, through unforeseeable, and foreseeable but disregarded, consequences. For example, addressing emissions of carbon dioxide from vehicles led to standards and legislation that sidelined the focus on other pollutants such as PMs and NOx, and to the promotion of diesel technology. This regulatory approach on reducing CO_2 emissions was widely embraced by the car industry which was already economically incentivised to develop diesel technology as a promising technology to reach new EU targets by setting new emissions standards. In fact, this approach may have incentivised car manufacturers such as Volkswagen to develop and deploy 'cheat' devices as the regulatory aims and discourse were about CO2 reduction.[72]

The second issue is the ability of the EU to ensure robust environmental compliance with regulatory measures. Compliance with EU environmental legislation has been an important issue.[73] Boerzel and

66. R. Baldwin, M. Cave and M. Lodge, *Understanding Regulation: Theory, Strategy, and Practice* (OUP, 2013); S. Kingston, V. Heyveart and A. Čavoški, *European Environmental Law* (CUP, 2017); V. Heyveart, *Transnational* Environmental Regulation and Governance: Purpose, Strategies and Principles (CUP, 2018); N. Gunningham, 'Environment Law, Regulation and Governance: Shifting Architectures' (2009) 21 *Journal of Environmental Law* 2.
67. Baldwin broadly discusses instances of market failure by examining monopolies and natural monopolies, windfall profit, externalities, information inadequacies, continuity and availability of service, anti-competitive behaviour and predatory pricing, public goods and moral hazard, unequal bargaining power, scarcity and rationing, rationalisation and coordination, and planning. See Baldwin et al above n. 66 at 15.
68. K. Anderson, 'Coaxing the Mitigation Phoenix from the Ashes of the EU ETS' (2013) blog post at https://kevinanderson.info/blog/coaxing-the-mitigation-phoenix-from-the-ashes-of-the-eu-ets/ and K. Anderson, 'Why Carbon Prices can't Deliver the 2°C target' (2013) blog post at http://kevinanderson.info/blog/why-carbon-prices-cant-deliver-the-2c-target/
69. From K. Anderson n. above 68: "Establishing a maximum emission standard for high-energy consuming devices and equipment, set at or around the level of the best commercially available and tightening at 8% to 10% p.a., would radically and rapidly reduce emissions".
70. See Baldwin et al above n. 66 at 107–108.
71. Ibid.
72. Above n. 65.
73. Compliance and Enforcement of EU Law, edited by M. Cremona, (Oxford University Press, 2012); ; C.F. Parker, 'Compliance' in B. Badie and others (eds), International Encyclopaedia of Political Science (SAGE, 2011); L. Borzsák, The Impact of Environmental Concerns on the Public Enforcement Mechanism under EU Law (Wolters Kluwer, 2011); R. Macrory, Regulation, Enforcement and Governance in Environmental Law (Hart Publishing, 2009); G. Falkner and O. Treib, 'Three Worlds of Compliance or Four? The EU-15 Compared to New Member States' (2008) 46 *JCMS* 293; P. Wenneås, *The Enforcement of EC Environmental Law* (Oxford University Press, 2007); I. Kilbey, 'Financial Penalties under Article 228(2) EC: Excessive Complexity?' (2007) 44 CMLR; C. Harlow and R. Rawlings, 'Accountability and Law Enforcement: the Centralised EU Infringement Procedure' (2006) *31* E.L.Rev 447; M. Burgstaller, Theories Of Compliance With International Law (Martinus Nijhoff, 2004)K. Raustiala and A.M. Slaughter, 'International Law, International Relations and Compliance' in

Buzogani[74] argue that the EU record in ensuring compliance has improved, or at least not deteriorated over time and through enlargements, but they attribute this more to political management of the policy-making process rather than to an increase in the capacity of regulators to enforce the law. The third and most important issue for the purposes of this article is serendipity and unforeseen consequences. As Wyatt points out, technology matters but technical choices have consequences.[75] The demand for compliance with regulation brings both foreseen and unforeseen, desired and undesired consequences. Lithium ion batteries for electric cars are seen as key to the transition to zero emission road transport. Yet, there are many environmental risks associated with this technology, including waste, boosting demand for electricity from non-renewable sources, and concerns about the environmental impact of mining lithium and cobalt used in the batteries.[76] However, these concerns can be addressed with appropriate standards and rules which would, for example, regulate responsible mining or impose products design standards for batteries followed by strict compliance of standards.

Finally, by recognising human agency, the EGD signals the authority that human agency, especially collective agency can have over technology and as such result in control that humans can exert over technology. The EGD has a strong political purpose to make this project one of European collective agency that spans everybody from the European Commission to Europe's citizens. It argues that citizens remain a driving force of the transition, while active public participation, commitment and engagement of "the public and of all stakeholders is crucial to the success of the EGD".[77] A role of the Commission is to ensure that the green transition occupies a significant place in the debate on the future of the EU.[78] The Commission reiterates the importance of confidence in this transition as a requirement for policies to be successfully implemented,[79] as well as the need for all EU actions and policies to assist in achieving "a successful and just transition towards a sustainable future"[80].

However, the success of involvement of people in this project partly as agents of change depends on preferences of actors involved in this green transition, including technological preferences. This is linked to a wider issue of cycle of technological development with one technology replacing another. Are the Commission's plans about the deployment of technology aligned with the preferences of citizens, industry, business and other actors that need to use those technologies? A good illustration was a switch to diesel technology which was sold as a 'clean' technology to be quickly abandoned after the Volkswagen saga. The immediate commitment to switch to electric cars and political commitments to net zero targets by 2050 had an immediate effect on consumers' behaviour which was not necessarily aligned to their own preferences. Similarly, there is a possibility that further change occurs, either through technological development, for example the roll out of hydrogen cars, or through market constraints or supply issues, for example

W. Carlnaes and others (eds), *The Handbook of International Relations* (SAGE 2002). J. Tallberg, 'Path to Compliance: Enforcement, Management and the European Union', (2002) 56 *International Organisations* 611; T.A. Börzel, 'Non -compliance in the European Union: pathology or statistical artefact?' (2001) 8 *Journal of European Public Policy* 803; M. Mendrinou, 'Non-compliance and the European Commission's Role in Integration' (1996) 3 *Journal of European Public Policy* 1; F. Snyder, "The Effectiveness of European Community Law: Institutions Process, Tools and Techniques' (1993) 56 *Modern Law Review* 19; A. Dashwood and R. White, 'Enforcement Actions under Article 169 and 170' (1989) 14 ELR 388; J Mertens de Wilmars and IM Verougstraete, 'Proceedings against Member States for Failure to Fulfil their Obligations' (1970) 7 *CMLR* 385;

74. T.A. Börzel and A. Buzogány, 'Compliance with EU Environmental Law. The Iceberg is Melting' (2019) 28(2) *Environmental Politics* 315–41.
75. See Wyatt, above n. 13 at 165.
76. See Čavoški, above n. 19 at 26–27.
77. Above n. 3 at 22.
78. Above n. 3 at 22.
79. Above n. 3 at 2.
80. Above n. 3 at 19.

the unavailability of rare earth metals for electric vehicles. Finally, consumer demand and preferences may change. A good example is decreasing number of young people driving cars due to number of complex factors.[81]

5. Conclusion

The EGD marked an important step in addressing climate change and related environmental issues. It represents a comprehensive environmental strategy that is implemented through various 'transformative policies' purportedly effecting change in multiple sectors. Despite very few references to technology, a closer examination of the policy discourse and transformative policies identified in this strategy indicates that that the EGD relies heavily on technology that will not only put the EU on a sustainable path but is also crucial for the fulfilment of its long-term economic objectives.

This article deployed technological determinism as an exploratory model to better understand the values of the EGD and the value placed on economic and environmental policies underpinned by technology. This explanatory model has a long tradition in political and social sciences but remains under-utilized in legal research. The applied theoretical model was instructive in establishing the value and applicability to environmental regulation governing different forms of green and digital technologies. This article concludes that despite the fact that the EGD is an environmental agenda, this strategy is framed as an economic proposition whereby different green, clean and digital technologies become determinants of economic growth. While the stated primary aim is to address climate and other environmental objectives, at times these appear secondary to economic objectives and the pursuit of economic growth in the EU. Technology is regarded as a key enabler for change, predominantly change that will lead to economic development. Though the EGD places importance on human agency in addition to technology as an agent in itself, the way transformative policies are conceived demonstrates that technology is regarded as the prime driver of change.

Moreover, the deployment of this explanatory model in the EGD discourse has important policy implications. An environmental agenda framed as an economic proposition through technology as a prime driver of change, raises interesting wider policy questions about the implications of technological determinism in the EGD. The main question is whether the EGD as a plausible economic policy underpinned by technology is at the same time a plausible environmental policy. The focus on addressing environmental issues within the wider context of creating new jobs and boosting growth and investment raises concerns of environmental protection having a predominantly instrumental value in creating more economically prosperous EU, while putting aside genuine effort to ensure environmental protection. This is indicative of the wider anthropocentric approach in the EGD which represents another avenue of future inquiry. Bearing in mind the long lineage of this approach in policy, as well as the ample evidence of further deterioration of the environment in the last several decades, there is a certain level of unease and scepticism in civil society regarding the potential of this environmental agenda to address current environmental problems.[82]

There is no doubt that the EGD sees technology as a necessary requirement for the transition to more sustainable economic growth. It is regarded as a prerequisite for the objectives of the policy to be achieved and change is unlikely to happen without technology. Technology is promised as a solution to problems that are foreseen. The EGD pledges to reach carbon neutrality by 2050 by deploying carbon removing technologies. However, such heavy reliance on technology begs a question whether technology becomes a necessary condition of change and what are the policy implications? To what extent does this heavy dependence on

81. Off-road: Why aren't Young People Driving? | Financial Times (ft.com).

82. See Greta Thunberg brands EU's New Climate Law 'Surrender' - BBC News; Fit for 55 – is the European Green Deal really leaving no-one behind? – CEPS.

technology overlook the importance of other drivers of change and as such the risks and issues in the social, economic and environmental arenas that are likely to remain unidentified or under-rated and may lead to potential problems? For example, every new technology brings a completely new class of environmental problems, some of which cannot be foreseen at the time when the policy is developed as for example evidenced by a complex life cycle of EV batteries. Moreover, new technologies may not necessarily remove problems brought by old technologies. Furthermore, this technological change cannot be achieved painlessly, without imposing costs and some level of disruption in society.

The article suggests that greater reliance on regulation for governing environmental pollution may shift the perspective on upholding technology as the main enabler of change and involving other actors of change such as businesses, industry and citizens. Environmental regulation becomes a mechanism to harness and control the use of technology. This approach is not fully endorsed in the EGD where the primary object of environmental regulation is still predominantly technology. However, the main caveat with environmental regulation results from the fact that regulation cannot mitigate all unintended consequences that technologies may bring as there will also be unknowns. Still, the success of environmental regulation depends on robust compliance which is another significant avenue of potential research within the context of the EGD. The Commission is committed to ensuring that legislation is enforced effectively through compliance which still remains a weak link in the EU. Moreover, the imposition of environmental regulatory standards should not be necessarily always accompanied by economic incentives. Finally, environmental regulation must be followed by social change as well. Although the EGD aims to generate agency in all citizens, technological determinism underpinned by beliefs in markets, undermines human agency and may this hinder the efforts of the EGD to affect social change.

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