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Sustainable Digital Sovereignty? Environmental Impact of EU Tech Strategies

Edoardo Celeste and Alba Perez Victorio

I. Introduction

The promises associated with digital technologies are manyfold. The 2030 Digital Compass does not only deem them 'imperative' for any professional and educational activities, entertainment and social interactions, the retail sector, and for accessing a wide range of services and experiences.[1] It also claims that they will contribute to a 'healthier and greener society.'[2] It is indeed expected that digitalisation will help achieve the EU sustainability goals set out in the European Green Deal. The so-called 'digitally enabled green solutions' shall thus play a key role in the transition towards a climate neutral, resource-efficient economy and society.[3] However, despite the EU's intention of linking its digital strategy with its sustainability objectives, one can criticise in practice lack of a coherent, effective and 'twin transitions' policy with a sufficient level of awareness of its global implications.[4]

Indeed, for the promises made by the EU to be fulfilled, the balanced impact of digital technologies on the environment shall be positive, not only in Europe but at the global level. Relying on the digital for a greener society is inherently complex since, although digital technologies may enhance resource efficiency, trace circular economy processes and enable sustainable design, they are also energy intensive. This challenge has been acknowledged by

[1] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions 2030 Digital Compass: the European way for the Digital Decade 2021 [COM(2021) 118 final] 1.

[2] European Commission Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions 2030 Digital Compass (n 1) 1.

[3] See, e.g., European Commission Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions 2030 Digital Compass (n 1) 3; European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' 3.

[4] Cf. European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3); Edoardo Celeste and Goran Dominioni, 'Digital and Green: Reconciling the EU Twin Transitions in Times of War and Energy Crisis' in Federico Fabbrini and Christy Anne Petit (eds), *Research Handbook on Post-Pandemic EU Economic Governance & NGEU Law* (Edward Elgar 2024).

the Commission,[5] but how the EU digital strategy will implement effective policies to overcome this issue is yet to be determined.

Moreover, while the policy emphasis on twinning the green and the digital transitions is strong, in this chapter we argue that it is not equally clear how the recent focus of the EU digital strategy in achieving a status of strategic independence from third countries may be compatible with the goals of the Green Deal. As illustrated by the contributors to the first part of this Volume, the concept of digital or technological sovereignty has not received a rigid, univocal definition at EU level.[6] Yet, it is possible to reconduct it to the idea of achieving a strategic independence from foreign actors in the digital field and regaining control on the components of digitalisation process. As we will explain in this chapter, this not only consists in trying to extend EU standards beyond its borders, but also encourages the strengthening of a digital industry made in the EU. While the first solution does not seem to negatively affect the environment, the second one de facto implies the creation almost *ex nihilo* of an EU digital sector through the reshoring of critical components of the digitalisation process from third countries. The ecological footprint of what in this chapter we will define the 'centripetal' approach of EU digital sovereignty strategies is more significant. The EU is 'duplicating' global digitalisation efforts, leading to higher energy and water consumption, higher exploitation of raw materials and waste generation, with a significant impact not only in the EU, but also at the global level.

This chapter thus aims to examine the environmental impact of EU technological strategies, ultimately challenging the idea that the Union is concretely envisaging a really sustainable form of digital sovereignty, in particular, by neglecting the consequences of digital policies beyond its borders. We start by tracing the genealogy of the digitalisation and green strategy in the EU, explaining to what extent they are currently considered as two 'twin' policies (II). We then focus on EU technology strategies, analysing how digital sovereignty has recently become a guiding principle in the context of a broader EU quest for strategic autonomy from third countries. Despite not being univocally defined, we illustrate how digital sovereignty strategies concretely take a 'centripetal' or a 'centrifugal' approach (III). The core contribution of our chapter then lies in the analysis of the environmental impact of EU technological policies as oriented by the EU objective of achieving a status of digital sovereignty. We will identify the generation of a rebound effect as the symptom of a 'digital insularity' attitude, where the EU still conceives the digital and green transitions as two siloed policies in terms of effects. We will finally introduce the concept of 'environmental sovereignism' to denote the adoption of a 'Europe first' attitude in setting twin transition strategies, which de facto neglects the impact of EU policies beyond its borders (IV). The last section will conclude presenting the theoretical alternative of starting to pursue a more digitally 'sober' approach (V).

II. Digital and Green: from siloed policies to a tandem vision

A. Digitalisation with the human at the centre

The emergence of the digital field as a top priority of the EU can be traced back to the 1990's. In 1993, the EU Commission adopted the White Paper 'Growth, Competitiveness, Employment

[5] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3) 2-3.

[6] See also Edoardo Celeste, 'Digital Sovereignty in the EU: Challenges and Future Perspectives' in Federico Fabbrini, Edoardo Celeste and John Quinn (eds), *Data Protection Beyond Borders: Transatlantic Perspectives on Extraterritoriality and Sovereignty* (Hart 2021).

– The Challenges and Way Forward into the 21st Century', the so-called 'Delors White Paper', in which it identified the emergence of a European 'information society'.[7] The 'dawn of the multimedia world', where digital technologies allow for a fast transmission of texts, images and sounds, provided unprecedented opportunities to individuals, considered both as consumers and as citizens, in terms of availability and customisability of products and accessibility to public services.[8] In 1994, the Bangemann Group Report to the European Council proposed a series of strategies to make the European information society thrive in the global context.[9] Liberalisation of the telecommunication sector, major investments in Internet infrastructures, attention to digital education, the development of harmonised regulatory frameworks in the fields of intellectual property, privacy, online security and media ownership, as well as fostering research and development of new technologies were among the key recommendations constituting the action plan of the High-Level Group that drafted the Report. Following these guidelines, the EU Commission adopted its first two action plans in 1994 and 1996.[10]

1999 saw the introduction of the e-Europe Action Plan, which aimed to enhance the digitalisation of the life of citizens, schools, public administrations and businesses; boost digital literacy; increase consumer trust and ensure social inclusiveness and cohesion.[11] The plan was further endorsed in the Lisbon European Council meeting of March 2020, which set its ambition to make the EU a leading 'knowledge-based' economy,[12] and further complemented by follow up plans in 2001, 2002 and 2005.[13] These policy instruments led to adoption of key regulatory instruments, which laid the foundations of EU digital law, such as the Data Protection Directive, the e-Commerce Directive and the Copyright Directive.[14]

In the aftermath of the 2007-2008 global financial crisis, the EU Commission launched its new Europe 2020 Strategy.[15] Digitalisation represented one of its seven flagship initiatives, leading

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[7] European Commission, White Paper 'Growth, Competitiveness, Employment – The Challenges and Way Forward into the 21st Century', COM(1993) 700.

[8] European Commission, White Paper 'Growth, Competitiveness, Employment', 22.

[9] High-Level Group on the Information Society, 'Europe and the global information society. Recommendations to the European Council', 26 May 1994. The High-Level Group took the name from the then EU Commissioner for Industry, Telecommunications, and Information Technology Martin Bangemann.

[10] European Commission, 'Europe's Way to the Information Society. An Action Plan', COM(1994)347 final; European Commission, 'Europe at the Forefront of the Global Information Society: Rolling Action Plan', COM(1996) 607.

[11] European Commission, 'eEurope - An information society for all', COM(1999) 687 final.

[12] European Council, 'Lisbon European Council 23 and 24 March 2000: Presidency Conclusions', <https://www.europarl.europa.eu/summits/lis1_en.htm#:~:text=PRESIDENCY%20CONCLUSIONS&text=The%20European%20Council%20held%20a,of%20a%20knowledge%2Dbased%20economy>.

[13] European Commission, 'eEurope 2002: Impact and Priorities A communication to the Spring European Council in Stockholm, 23-24 March 2001', COM(2001) 140 final; European Commission, 'eEurope 2005: An information society for all - An Action Plan to be presented in view of the Sevilla European Council, 21/22 June 2002', COM(2002) 263 final; European Commission, 'i2010 – A European Information Society for growth and employment', COM(2005) 229 final.

[14] Respectively, Directive 95/46/EC; Directive 2000/31/EC and Directive 2001/29/EC.

[15] European Commission, 'Europe 2020: A strategy for smart, sustainable and inclusive growth', COM(2010) 2020 final.

to the adoption of a comprehensive policy strategy named 'A Digital Agenda for Europe',[16] further detailed in 2015 by the Digital Single Market Strategy.[17] The first EU digital agenda identified seven key areas of intervention: the digital internal market, interoperability and standards, trust and security, fast Internet access, research and innovation, digital literacy and skills, and digital technology benefits for the EU society, including for the environment. Data regulation was certainly one of the distinctive features of the EU digital agenda 2010-2020. Indeed, this decade saw the repealing of the first Data Protection Directive of 1995 with the General Data Protection Regulation (GDPR),[18] the adoption of a directive to protect personal data in the context of law enforcement,[19] a regulation on the free flow of non-personal data,[20] a recast directive on open data and the re-use of public sector information,[21] a directive on security of network and information systems,[22] and a regulation confirming the role of the EU cybersecurity agency ENISA.[23]

In 2020, the Commission introduced a new policy document to define the objectives of the 'Digital Decade' (2020-2030),[24] further complemented by the communications 'Forging Europe's digital future'[25], 'Europe's digital decade'[26] and 'EU Digital Compass'.[27] In these documents, digital technology is presented as having to play a double function: on the one hand, it seeks to boost the efficiency of the internal market, while, on the other hand, it contributes to affirm the EU as a standard-setter in the digital field at global level. The Commission introduced the image of the 'digital compass' to identify the four cardinal points of the EU digitalisation strategy, namely the enhancement of digital skills among the European population, the digitalisation of businesses and the public sector, and the improvement of

[16] European Commission, 'A Digital Agenda for Europe', COM(2010)245 final.

[17] European Commission, 'A Digital Single Market Strategy for Europe, COM(2015) 192'.

[18] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC.

[19] Directive (EU) 2016/680 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA.

[20] Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union.

[21] Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information. This directive recast rules in this field following the substantial amendments of Directive 2003/98/EC.

[22] Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union.

[23] Regulation (EU) 2019/881 of the European Parliament and of the Council of 17 April 2019 on ENISA (the European Union Agency for Cybersecurity) and on information and communications technology cybersecurity certification and repealing Regulation (EU) No 526/2013 (Cybersecurity Act).

[24] European Commission, 2030 Policy Programme "Path to the Digital Decade" [COM(2021) 574 final], para 3.

[25] European Commission. Directorate General for Communications Networks, Content and Technology, Shaping Europe's Digital Future. (Publications Office 2020) <https://data.europa.eu/doi/10.2759/091014>.

[26] European Commission (n 13).

[27] European Commission, Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions - 2030 Digital Compass: the European Way For The Digital Decade 2021 [COM(2021) 118 final].

digital infrastructures. The last few years saw a new wave of intense legislative activity in the digital field – a phenomenon dubbed as 'actification' by legal scholars - which led to the adoption of seminal normative instruments, mostly in the form of regulations.[28] The list is quite extensive; however, one can mention examples such as the Data Governance Act on the re-use of publicly held data,[29] a new directive on network and information systems,[30] the Digital Services Act on content moderation by digital platforms,[31] the Digital Markets Act to ensure more competition in the digital single market,[32] and the AI Act, which represents the first comprehensive regulatory instrument at global level aiming to govern the development and use of AI systems.[33]

B. From carbon emissions targets to a just transition

In 2019, the EU Commission adopted its first green transition comprehensive strategy in a communication entitled 'The European Green Deal'.[34] Enhancing the level of sustainability and contrasting climate change are presented as common objectives that should inform all EU key policy actions. Four are the core directions pursued by the Green Deal: carbon emissions reduction, sustainable energy and mobility, sustainable and circular economy, and just transition.

In terms of carbon emission reduction, the European Climate Law entered into force in 2021 as a legally binding regulation requiring all member states to reduce by 55% their 1990 carbon emissions levels by 2030 and achieve carbon neutrality by 2050.[35] The Commission further specified the strategy to achieve these objectives in a communication that detailed the so-called 'Fit for 55' package – 55 as the percentage of carbon reduction targeted by the EU – a series of legislative reforms focusing on all the key economic sectors.[36] The package included the reform of the EU Emission Trading System (ETS), the cap-and-trade mechanism introduced in 2005

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[28] Vagelis Papakonstantinou and Paul De Hert, 'The Regulation of Digital Technologies in the EU: : The Law-Making Phenomena of "Act-Ification", "GDPR Mimesis" and "EU Law Brutality"' [2022] Technology and Regulation 48.

[29] Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act).

[30] Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2 Directive).

[31] Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market For Digital Services and amending Directive 2000/31/EC (Digital Services Act).

[32] Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and (EU) 2020/1828 (Digital Markets Act).

[33] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act).

[34] EU Commission, 'The European Green Deal' (2019) COM(2019) 640 final.

[35] Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').

[36] European Commission, '"Fit for 55": Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality, COM(2021) 550 Final'.

to reduce carbon emissions, with the aim to further lower the overall caps and include new sectors, such as aviation and maritime transport.[37] All the Fit for 55 legislative proposals were adopted by November 2023.[38]

In the field of sustainable energy and transportation, in 2022 the Commission launched the REPowerEU Plan to decrease the EU dependency from Russian gas following the start of the Ukrainian war.[39] Also boosted by this development, in 2023 the EU revised the Renewable Energy Directive 2018 seeking to enhance the percentage of renewable energy by 2030,[40] and adopted the Energy Efficiency Directive, which established stricter standards in terms of energy efficiency for buildings, appliances and various industry sectors.[41] The Sustainable and Smart Mobility Strategy was presented in 2020.[42] Its objective is to achieve a 90% emission reduction by 2050, boost the production and use of carbon neutral vehicles and enhance the quality of the European rail network.

Similarly, the Commission introduced three strategies in the area of sustainable and circular economy: the Circular Economy Action Plan, aiming to reduce waste and promote re-use and recycling;[43] the Sustainable Finance Strategy, which seeks to foster boost private investments in sustainability actions;[44] and the Farm to Fork Strategy, which contributes to limit the environmental impact of the food system.[45]

All these changes have repercussions on the social texture, reason for which the Commission has focused its recent work also on establishing a Just Transition Fund[46] to compensate individuals whose life and jobs had to change following the climate change mitigation measures adopted by the EU as well as on increasing public participation, social dialogue and skills development.[47]

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[37] For more details see Celeste and Dominioni (n 4).

[38] See the timeline at https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en.

[39] European Commission, 'REPowerEU Plan', COM(2022) 230 final.

[40] Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652. Directive (EU) 2018/2001 at its turn recast the first Renewable Energy Directive (Directive 2009/28/EC).

[41] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast). The first directive on energy efficiency was Directive 2012/27/EU, subsequently amended by Directive (EU) 2018/2002.

[42] European Commission, 'Sustainable and Smart Mobility Strategy – putting European transport on track for the future', COM(2020) 789 final; European Commission,

[43] European Commission, 'A new Circular Economy Action Plan. For a cleaner and more competitive Europe', COM(2020) 98 final. The first circular economy package was adopted in 2015: see European Commission, 'Closing the loop - An EU action plan for the Circular Economy', COM(2015) 614 final.

[44] European Commission, 'Strategy for Financing the Transition to a Sustainable Economy', COM(2021) 390 final.

[45] European Commission, 'A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system', COM/2020/381 final.

[46] Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund.

[47] European Commission, 'Strengthening social dialogue in the European Union: harnessing its full potential for managing fair transitions', COM(2023) 40 final; European Commission, 'European Skills Agenda for sustainable

C. Twinning digital and green

Following the Covid-19 pandemic, 2020 saw the adoption of the Next Generation EU (NGEU) Plan: not a further policy strategy, but rather a new mechanism to boost the EU economy following the slow down dictated by the global spread of Coronavirus.[48] NGEU is an unprecedented instrument that provides further funding to core EU policies in order to fill the gap generated by the pandemic and make the EU system more resilient. The Recovery and Resilience Facility (RFF) is the financial engine of NGEU: the motto of the initiative 'for a greener, more digital and more resilient EU' well exemplifies the priorities of this plan.[49] Digitalisation and green transition are presented as two transversal policy objectives informing all areas of intervention, from the economy to health and education.[50]

In 2022, the EU Commission published its annual Strategic Foresight Report on the relationship between green and digital transformation, building on a more comprehensive study carried out by the Joint Research Centre.[51] This document marked the official coupling of digitalisation and green transformation in the EU, as these two policies were mostly developed separately beforehand.[52] The report indeed analyses the promises and challenges of 'twinning' climate change mitigation strategies and the digital transformation amidst the complex geopolitical scenario following the Russian invasion of Ukraine and its consequent economic effects in Europe. It is recognised that a comprehensive and contextual analysis of these two parallel transitions is needed, due to their intrinsic 'geopolitical nature'.[53] The different factors pushing for the digital and green transitions are recognised, but the document stresses the need to analyse more in depth how these two policy areas can be 'twinned', in the sense of possibility of 'reinforcing' each other.[54] In particular, ten key areas of intervention are identified.[55]

The main benefits identified by the Commission in deploying digital technologies in the context of the green transition are related to their monitoring, forecasting, reporting and simulating capacity. Digital technologies can help to monitor resource and energy use in a variety of

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competitiveness, social fairness and resilience', COM(2020) 274 final; European Commission, 'Conference on the Future of Europe: Putting Vision into Concrete Action, COM(2022) 343 final.

[48] See Federico Fabbrini, 'The Legal Architecture of the Economic Responses to COVID-19: EMU beyond the Pandemic' (2022) 60 JCMS: Journal of Common Market Studies 186.

[49] European Commission. Directorate General for Economic and Financial Affairs., *Quantifying Spillovers of next Generation EU Investment.* (Publications Office 2021), <https://data.europa.eu/doi/10.2765/80561>.

[50] European Commission, Review report on the implementation of the Recovery and Resilience Facility [COM(2022) 383 final].

[51] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3); see also European Commission, Joint Research Centre., 'Towards a Green & Digital Future: Key Requirements for Successful Twin Transitions in the European Union.' (Publications Office 2022) <https://data.europa.eu/doi/10.2760/977331> accessed 28 February 2024.

[52] Celeste and Dominioni (n 4).

[53] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3) 1.

[54] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3) 1.

[55] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3) 12 ff.

sectors. This element generally enhances efficiency, decreasing environmental impact and contributing to the implementation of a more circular economy. In particular, AI systems processing big set of data have the potential to produce forecasts and increase efficiency in a broad array of sectors, from smart grids to smart cities.[56] The capability of digital technology to process data and generate reports can foster public participation in innovation and decision making.[57] Technologies, such as digital twins, which are 'digital representations' of real products or processes,[58] and quantum computing, new computing systems relying on quantum physics,[59] can generate simulations to design more efficient and sustainable solutions.

At the same time, embedding green objectives into the EU digitalisation strategy first of all means limiting energy consumption and improving its efficiency. Indeed, the current use of digital devices and services has a significant impact on energy consumption, especially if one considers the high energy consumption of data centres and blockchain mining.[60] On top of it, it is also expected an overall increase in energy use due to technological developments.[61] Secondly, greening digital technologies also implies reducing their environmental footprint in the phases before and after their use. Manufacturing digital devices requires the exploitation of rare metals with a considerable environmental impact associated with mining.[62] Data centres require a significant use of water for cooling off.[63] Moreover, digital development generates problems in relation to waste management.[64]

Finally, twinning the digital and green transitions cannot succeed without a proper societal transformation. Bertrand significantly speaks of the challenges of a 'triple' transition, as digitalisation and climate change mitigation unavoidably impact on society.[65] First of all, in

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[56] See Rajan Jose and others, 'Artificial Intelligence-Driven Circular Economy as a Key Enabler for Sustainable Energy Management' (2020) 2 Materials Circular Economy 8; Matthew Wilson, Jeannette Paschen and Leyland Pitt, 'The Circular Economy Meets Artificial Intelligence (AI): Understanding the Opportunities of AI for Reverse Logistics' (2021) 33 Management of Environmental Quality: An International Journal 9.

[57] See Joeri Naus, Bas JM Van Vliet and Astrid Hendriksen, 'Households as Change Agents in a Dutch Smart Energy Transition: On Power, Privacy and Participation' (2015) 9 Energy Research & Social Science 125; Cuihong Zhang, Ning Liu and Maoling Yuan, 'More Is Better? Stakeholder Participation in Regulatory Rule-Setting towards Green Transition' (2024) 349 Journal of Environmental Management 119484.

[58] David Jones and others, 'Characterising the Digital Twin: A Systematic Literature Review' (2020) 29 CIRP Journal of Manufacturing Science and Technology 36.

[59] See Akshay Ajagekar and Fengqi You, 'Quantum Computing and Quantum Artificial Intelligence for Renewable and Sustainable Energy: A Emerging Prospect towards Climate Neutrality' (2022) 165 Renewable and Sustainable Energy Reviews 112493.

[60] See Beth Whitehead and others, 'Assessing the Environmental Impact of Data Centres Part 1: Background, Energy Use and Metrics' (2014) 82 Building and Environment 151; Jingming Li and others, 'Energy Consumption of Cryptocurrency Mining: A Study of Electricity Consumption in Mining Cryptocurrencies' (2019) 168 Energy 160.

[61] See below Section IV on the rebound effect.

[62] See Fraunhofer Institute for Systems and Innovation Research ISI and others, *Critical Metals in the Path towards the Decarbonisation of the EU Energy Sector: Assessing Rare Metals as Supply Chain Bottlenecks in Low Carbon Energy Technologies* (Publications Office of the European Union 2013) <https://data.europa.eu/doi/10.2790/46338> accessed 2 July 2023.

[63] See Whitehead and others (n 60).

[64] See Rashmi Anoop Patil and Seeram Ramakrishna, 'A Comprehensive Analysis of E-Waste Legislation Worldwide' (2020) 27 Environmental Science and Pollution Research 14412.

[65] Brunessen Bertrand, 'The Twin Digital and Green Transition Comment la transition numérique s'inscrit-elle dans les objectifs du Green Deal ?' [2022] RTDEur. Revue trimestrielle de droit européen 619.

terms of employment, by threatening the existence of some types of profession and creating new ones. Secondly, in terms of education, as new technologies and greener solutions require a series of skills. The EU Commission too is aware of this challenge, pledging in its 2022 Strategic Foresight report that 'the twin transitions will be fair or will not be'.[66]

III. EU digital sovereignty as strategic autonomy

A. Contrasting digital dependence: the EU quest for digital sovereignty

The first two decades of the EU digitalisation process aimed to achieve a smart growth while supporting a liberal idea of an open digital market. This led to an overall condition of structural dependence of the EU from foreign companies for the provision of digital services and goods. The scholarship speaks of 'digital dependence' to denote a status where 'actors in a particular country have to rely on foreign-controlled digital technologies to perform digital activities.'[67] Mayer and Lu proposed a digital dependence index, categorising countries according to their level of digital independence, from absolute autarky to absolute dependence.[68] The bloc of EU countries presents a high level of digital dependence from two 'technopoles'. On the one hand, the EU relies on the US for the provision of digital infrastructures and services. On the other hand, it is dependent on China for the purchase of digital goods. The US conversely emerge as the most digital independent country, followed by China and South Korea.

The EU status of digital dependence has been perceived as an element of vulnerability. Both from an economic perspective, as the EU is unavoidably subject to the ebbs and flows of foreign markets - a risk that has been exacerbated by the recent trade war between the US and China.[69] And, from a legal perspective, as EU institutions, companies and individuals are exposed to threats of espionage, cyberattacks and fundamental rights violations. Also in this case, this is a concrete, and not a purely academic concern. Indeed, the Snowden revelations in 2013 have unveiled a system of mass surveillance put in place by US authorities also vis-à-vis EU individuals.[70] The legal arm-wrestling in relation to the transfer of EU personal data to the US is another evidence of a question that has not been fully solved yet.[71] US law enforcement authorities are legally authorised to access data transferred to US companies, but the conditions

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[66] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3) 10.

[67] Maximilian Mayer and Yen-Chi Lu, 'Digital Autonomy? Measuring the Global Digital Dependence Structure' (Center for Advanced Security, Strategic and Integration Studies 2022) 2 <https://www.kas.de/documents/252038/16166715/Digital+Autonomy+-+Measuring+the+Global+Digital+Dependence+Structure.pdf/fb97d384-53fd-b747-908f-2c86e8d0674b?version=1.2&t=1651491803819>.

[68] Mayer and Lu (n 67).

[69] Chad P Bown, 'The US–China Trade War and Phase One Agreement' (2021) 43 Journal of Policy Modeling 805.

[70] See Ioanna Tourkochoriti, 'The Snowden Revelations, the Transatlantic Trade and Investment Partnership and the Divide between U.S.-E.U. in Data Privacy Protection' (2014) 36 University of Arkansas at Little Rock Law Review 161.

[71] See Maria Tzanou, 'Schrems I and Schrems II: Assessing the Case for the Extraterritoriality of EU Fundamental Rights' in Federico Fabbrini, Edoardo Celeste and John Quinn (eds), *Data Protection Beyond Borders: Transatlantic Perspectives on Extraterritoriality and Sovereignty* (Hart 2021).

of such access violate EU data protection law. Moreover, the US CLOUD Act allows US authorities to access data held by companies incorporated in the US, regardless of whether they operate.[72] And the situation on the Chinese front is not more idyllic, having China passed in 2017 a new National Intelligence Law, which, similarly to the US CLOUD Act authorises intelligence authorities to access data held by Chinese companies operating abroad.[73]

The beginning of the so-called 'digital decade' (2020-2030) has thus witnessed the emergence of a quest for EU digital sovereignty fuelled by these economic and geopolitical risks. In the 2020 Communication 'Shaping Europe's Digital Future', the EU Commission stressed the need to reduce the EU dependence from other global players by enhancing 'technological sovereignty' intended as 'Europe's ability to define its own rules and values in the digital age' combined with an autonomous development and deployment of its own digital capacities.[74] Indeed, the EU standard setting power in the digital field might be undermined if digital infrastructures and devices are provided by foreign actors. However, digital sovereignty is not presented by the EU as determining a closure of the single market, i.e. as a form of digital protectionism or techno nationalism. The Commission attempts to reconcile its vision of digital sovereignty as strategic autonomy from other countries with the openness that has characterised the digital single market in the previous decades.[75] If, on the one hand, it is recognised that European needs and values are prioritised, on the other hand, such an approach does not aim to penalise foreign actors.[76] Certainly a vision which might be subject to criticism.[77]

The current EU digitalisation strategy is no longer economically and geopolitically neutral. The EU does not aim to achieve a digitalisation *tout court*, but technological sovereignty acts as an orientating principle. The emergence of this new guiding value in EU policy has not been

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[72] See Steven Smith, 'Clouds on the Horizon: Cross-Border Surveillance Under the US CLOUD Act' in Federico Fabbrini, Edoardo Celeste and John Quinn (eds), *Data Protection Beyond Borders: Transatlantic Perspectives on Extraterritoriality and Sovereignty* (Hart 2021).

[73] PRC National Intelligence Law (as amended in 2018) 2017, as translated into English via https://www.chinalawtranslate.com/en/national-intelligence-law-of-the-p-r-c-2017/#_Toc486408897. For an analysis of the Chinese technological reach, see, e.g., Edward Schwarck, 'Intelligence and Informatization: The Rise of the Ministry of Public Security in Intelligence Work in China' (2018) 80 The China Journal 1; Ausma Bernot and Marcus Smith, 'Understanding the Risks of China-Made CCTV Surveillance Cameras in Australia' (2023) 77 Australian Journal of International Affairs 380; Gregory J Moore, 'Huawei, Cyber-Sovereignty and Liberal Norms: China's Challenge to the West/Democracies' (2023) 28 Journal of Chinese Political Science 151.

[74] EU Commission, 'Shaping Europe's Digital Future' (2020) COM(2020) 67 final 2 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0067>.

[75] Cf. also 'European Declaration on Digital Rights and Principles' (2022) <https://digital-strategy.ec.europa.eu/en/library/european-declaration-digital-rights-and-principles>, Recital 6.

[76] An example of that is the expressed aim to cooperate with non-EU countries through digital partnerships. See European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions 2030 Digital Compass: the European way for the Digital Decade 2021 [COM(2021) 118 final] 18-20. The impact has also sometimes been considered while drafting legislation. In the Impact Assessment accompanying the Digital Services Act, the Commission took into account the effect of the measure on non-EU legitimate platforms that operate in the UE. See European Commission, Commission Staff Working Document Impact Assessment Accompanying the document Proposal for a Regulation of the European Parliament and of the Council on a Single Market For Digital Services (Digital Services Act) and amending Directive 2000/31/EC 2020 [SWD(2020) 348 final] 58.

[77] See Edoardo Celeste, Victor Henriquez Diaz and Elio Loredo Machado Neto, 'EU Digital Sovereignty as Strategic Autonomy: A Justified Protectionist Model?', *Annual International Conference 'International Trade and New Technologies', The governance of digital trade: crossroads of divergent approaches* (2023).

accompanied with a high degree of clarity from a policy-making perspective.[78] The notion of digital sovereignty has not been univocally defined, but has rather been progressively incorporated into EU policy from the political rhetoric of some EU countries – especially France and Germany.[79] Certainly, the difficulty of identifying a scholarly definition of the notion of 'sovereignty' itself, a concept that has significantly evolved over time, does not contribute to shed light on the concept of digital sovereignty.[80] Moreover, the use of this expression was preceded by terms such as 'technological sovereignty', which appears already in the 1960's,[81] and 'data sovereignty', now intended as a subset of the notion of digital sovereignty with specific reference to data.[82] The meaning that the scholarship has given to digital sovereignty claims in the EU context relates to the idea of regaining control over data, digital infrastructures and services, software and hardware. Controlling the digital consists in the possibility to apply EU fundamental rights and value in an autonomous way, thus with an appropriate degree of independence from external influence.

Digital sovereignty claims at EU level emerge from the need to 'control the digital', indented by the ecosystem encompassing data, infrastructures, software, hardware and services which represent the pillars of the digital society.[83] Such 'control' of the digital ecosystem consists – at least in theory – in the possibility to apply EU values and rules to digital assets.[84] However, that regulatory power, to be effective, presupposes a status of relative strategic autonomy of the EU in the digital field to progressively attained with a series of policy and regulatory strategies.

B. EU digital autonomy strategies: centripetal and centrifugal tendencies

Digital independence is not a self-standing element in the EU policy agenda. It is tied into a broader strategy aiming at enhancing EU resilience and open strategic autonomy in the current

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[78] Cf. the various discourses surrounding the idea of digital sovereignty in Julia Pohle and Thorsten Thiel, 'Digital Sovereignty' (2020) 9 Internet Policy Review.

[79] Celeste, 'Digital Sovereignty in the EU: Challenges and Future Perspectives' (n 6).

[80] See Hent Kalmo and Quentin Skinner (eds), *Sovereignty in Fragments: The Past, Present and Future of a Contested Concept* (Cambridge University Press 2010).

[81] Stephane Couture and Sophie Toupin, 'What Does the Notion of "Sovereignty" Mean When Referring to the Digital?' (2019) 21 New Media & Society 2305.

[82] Couture and Toupin (n 81); on the use of the concept of data sovereignty as an aspect of digital sovereignty see Federal Ministry for Economic Affairs and Energy (BMWi), 'Project GAIA-X - A Federated Data Infrastructure as the Cradle of a Vibrant European Ecosystem' (2019) <https://www.bmwi.de/Redaktion/EN/Publikationen/Digitale-Welt/project-gaia-x.pdf?__blob=publicationFile&v=4>. Such an evolution should not surprise as it reflects the perception of technological changes in the contemporary society: see Edoardo Celeste, 'The Scope of Application of Digital Constitutionalism. Output from an Empirical Research' (Nexa Research Papers 2017) Nexa Research Papers <https://nexa.polito.it/nexacenterfiles/E.%20Celeste%20-%20Research%20Paper.pdf>.

[83] See Luciano Floridi, 'The Fight for Digital Sovereignty: What It Is, and Why It Matters, Especially for the EU' (2020) 33 Philosophy & Technology 369, 371; Patrik Hummel and others, 'Data Sovereignty: A Review' (2021) 8 Big Data & Society <http://journals.sagepub.com/doi/10.1177/2053951720982012> accessed 18 May 2022.

[84] Celeste, 'Digital Sovereignty in the EU: Challenges and Future Perspectives' (n 6); See Edoardo Celeste, 'Digital Constitutionalism, EU Digital Sovereignty Ambitions and the Role of the European Declaration on Digital Rights' in Annegret Engel, Xavier Groussot and Gunnar Thor Petursson (eds), *New Directions in Digitalisation: Perspectives from EU Competition Law and the Charter of Fundamental Rights* (Springer 2024).

geopolitical framework.[85] As argued in the 2022 Strategic Foresight Report, this includes, for instance, energy efficiency and food security.[86] This document follows the path paved by the 2021 Strategic Foresight Report, which had already identified the 'megatrends' affecting EU strategic autonomy, namely climate change and environmental challenges, the digital and technological transformation, and shifts in global politics including threats to democratic governance as well as demographic changes.[87]

This phase clearly sees the emergence of the defence of EU digital sovereignty as a key policy objective to compete against the superpower of US and Chinese tech firms and, at the same time, preserve EU fundamental rights and liberties.[88] To this end, the second EU digital agenda stresses the importance of investing in a human-centric form of artificial intelligence that preserves fundamental rights, developing EU digital infrastructures including supercomputing facilities, enhancing the cybersecurity of the whole chain of EU digital systems, ensuring high levels of connectivity through fast broadband, 5G and 6G technologies, as well as controlling the use of semiconductors which are necessary to make chips.[89]

The EU, not being home to digital infrastructure and service providers, nor to manufacturers or suppliers of digital products, has employed a twofold strategy to achieve autonomy in the digital, balancing centripetal and centrifugal tendencies.[90] While centripetal policy measures aim to reshore digital assets such as data or digital infrastructure within the EU physical borders to keep – or gain – control over them, centrifugal measures aim to extend the EU's regulatory influence beyond its borders, namely through the extraterritorial scope of EU law or by acting as a global norm-setter.

The paradigmatic example of how the EU implements digital sovereignty in a centripetal way are data localisation measures.[91] In this regard, the European Strategy for Data envisaged the so-called 'High Impact Project: developing common European data spaces and interconnecting cloud infrastructures', which aims to establish common and interoperable data spaces in the

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[85] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 43) 12.

[86] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 43) 12-13.

[87] European Commission, '2021 Strategic Foresight Report - The EU's capacity and freedom to act 2021, COM(2022) 289 Final'.

[88] See Edoardo Celeste, 'Digital Sovereignty in the EU: Challenges and Future Perspectives' in Federico Fabbrini, Edoardo Celeste and John Quinn (eds), *Data Protection Beyond Borders: Transatlantic Perspectives on Extraterritoriality and Sovereignty* (Hart 2021).

[89] European Commission, Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions 2030 Digital Compass (n 1).

[90] This distinction has been illustrated in Celeste, 'Digital Sovereignty in the EU: Challenges and Future Perspectives' (n 71) and Edoardo Celeste, 'Brexit and the Risks of Digital Sovereignism' in Edoardo Celeste and others (eds), *Data Protection and Digital Sovereignty Post-Brexit* (Hart (Bloomsbury Publishing) 2023) <https://www.bloomsbury.com/uk/data-protection-and-digital-sovereignty-postbrexit-9781509966486/>.

[91] For examples in Europe, the US and China, see Edoardo Celeste and Federico Fabbrini, 'Competing Jurisdictions: Data Privacy Across the Borders' in Theo Lynn and others (eds), *Data Privacy and Trust in Cloud Computing: Building trust in the cloud through assurance and accountability* (Springer International Publishing 2021) <https://doi.org/10.1007/978-3-030-54660-1_3>.

EU.[92] Other policy measures such as the Gigabit Infrastructure Act[93] and the Chips Act[94] have focused on digital infrastructure localisation. The first aims to promote the use of existing as well as the deployment of new high-capacity fixed and wireless networks across the EU.[95] On the other hand, the Chips Act acknowledges the importance of chips as a strategic asset for key industrial value chains and aims to strengthen the EU's semiconductor ecosystem.[96] To achieve these objectives, this regulation includes the establishment of the 'Chips for Europe Initiative', which seeks to build extensive technological capacity and support research and innovation activities across the EU semiconductor value chain, enhancing advanced design, systems integration and chip production to boost competitiveness.[97]

Regarding the centrifugal tendency, the extraterritorial effect and de facto influence of EU digital law, and in particular of the GDPR, are well-known and have been thoroughly discussed in the literature.[98] In addition, the EU has shown a growing interest in establishing itself as a global norm-setter in the digital field. The Standardisation Strategy argues that the EU 'strong global footprint' in setting international standards is jeopardised by the current geopolitical context.[99] Therefore, measures shall be taken to uphold such global footprint and to ensure EU competitiveness and the promotion of EU values. More recently, the text of the AI Act pledges EU global leadership in the uptake of 'secure, trustworthy and ethical AI'.[100]

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[92] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions A European strategy for data 2020 [COM/2020/66 final]. On the status of the common European data spaces, see European Commission, 'Commission Staff Working Document on Common European Data Spaces' (2022) SWD(2022) 45 final <https://digital-strategy.ec.europa.eu/en/library/staff-working-document-data-spaces> and European Commission, 'Commission Staff Working Document on Common European Data Spaces' (2024) SWD(2024) 21 final <https://digital-strategy.ec.europa.eu/en/library/second-staff-working-document-data-spaces>.

[93] Regulation (EU) 2024/1309 of the European Parliament and of the Council of 29 April 2024 on measures to reduce the cost of deploying gigabit electronic communications networks, amending Regulation (EU) 2015/2120 and repealing Directive 2014/61/EU (Gigabit Infrastructure Act) (Text with EEA relevance) 2024.

[94] Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 establishing a framework of measures for strengthening Europe's semiconductor ecosystem and amending Regulation (EU) 2021/694 (Chips Act) (Text with EEA relevance).

[95] Gigabit Infrastructure Act, Article 1.

[96] Chips Act, Preamble (1) and (2).

[97] Chips Act, Preamble (4), Article 1.1.(a) and Articles 3 to 12.

[98] See, e.g., Christopher Kuner, 'The Internet and the Global Reach of EU Law' in Marise Cremona and Joanne Scott (eds), *EU Law Beyond EU Borders: The Extraterritorial Reach of EU Law* (Oxford University Press 2019); Oskar Josef Gstrein and Andrej Janko Zwitter, 'Extraterritorial Application of the GDPR: Promoting European Values or Power?' (2021) 10 Internet Policy Review <https://policyreview.info/articles/analysis/extraterritorial-application-gdpr-promoting-european-values-or-power> accessed 13 May 2022; Anu Bradford, *The Brussels Effect: How the European Union Rules the World* (Oxford University Press 2020); Federico Fabbrini, Edoardo Celeste and John Quinn (eds), *Data Protection beyond Borders: Transatlantic Perspectives on Extraterritoriality and Sovereignty* (Hart 2021).

[99] See European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions An EU Strategy on Standardisation Setting global standards in support of a resilient, green and digital EU single market 2022 [COM/2022/31 final].

[100] Recital 8.

IV. Environmental impact of digital sovereignty strategies

A. Rebound effect and digital insularity

While implementing digital sovereignty strategies, the EU unavoidably increases the global use of digital technologies. Indeed, the 2030 Digital Compass aims to accelerate Europe's digital transformation, which involves harnessing investments to develop critical technologies that are now mostly developed outside the EU.[101] Although the EU aims to pursue a more sustainable digital future through high environmental standards, the ecological footprint of digital technologies cannot be overlooked. Indeed, as anticipated above, the digital sector requires energy and natural resources, and produces high amounts of waste.[102]

Recent assessments have estimated the energy use of devices, data centres and networks to account for a 6 to 12% of global electricity use.[103] In the EU, data centres alone used approximately 45 to 65 TWh of electricity in 2022 (1.8 and 2.6% of EU total electricity consumption), with technologies such as artificial intelligence (AI) and blockchain and cryptocurrency being likely to impact this consumption.[104] The total bitcoin energy consumption of 121 TWh in 2023 is evidence of that.[105] While the carbon emissions associated to this consumption have garnered increasing attention, other environmental impacts such as water consumption and noise pollution have been disregarded.[106] For instance, water-based cooling technologies used in data centres placed them among the top ten water-intensive industries in the US in 2018.[107] Moreover, digital hardware and infrastructure require high amounts of raw materials, namely different types of metals, elements and minerals.[108] Mining activities to obtain them are usually associated with environmental and social negative impacts.[109] Finally, given the short lifespan of ICT hardware due to malfunctioning, technical obsolescence, or other reasons, devices are being constantly replaced by digital users.[110] This generates a huge annual amount of e-waste, which is predicted to reach almost 75 Mt by 2030.[111]

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[101] 2030 Digital Compass, 3.

[102] See, e.g., Stefano Bianchini, Giacomo Damioli and Claudia Ghisetti, 'The Environmental Effects of the "Twin" Green and Digital Transition in European Regions' (2023) 84 Environmental & resource economics 877. For a report on the nature and scale of the environmental footprint of digital technologies, see United Nations Conference on Trade and Development (UNCTAD), *Digital Economy Report 2024* (2024) <https://unctad.org/system/files/official-document/der2024_en.pdf> accessed 18 July 2024.

[103] United Nations Conference on Trade and Development (UNCTAD) (n 103).

[104] Joint Research Centre (European Commission), G Kamiya and P Bertoldi, *Energy Consumption in Data Centres and Broadband Communication Networks in the EU* (Publications Office of the European Union 2024) <https://data.europa.eu/doi/10.2760/706491>.

[105] See 'Cambridge Blockchain Network Sustainability Index' <https://ccaf.io/cbnsi/cbeci>.

[106] United Nations Conference on Trade and Development (UNCTAD) (n 94) 71.

[107] United Nations Conference on Trade and Development (UNCTAD) (n 94) 83-84.

[108] A report from the Geological Survey of Finland distinguishes between 1) high-tech metals, 2) battery metals and minerals, and 3) other metals, elements and minerals. See Jyri Hanski and others, *Digitalization and Natural Resources* (Geological Survey of Finland 2021) 29.

[109] See United Nations Conference on Trade and Development (UNCTAD) (n 94) 59-64

[110] Hanski and others (n 109).

[111] E-waste is problematic not only because of its volume, but also because of its partly hazardous content. See Hanski and others (n 109).

Despite the promises of using digital technologies to overcome the challenges related to climate change in the EU, the Commission also recognized that digitalisation will unavoidably increase energy consumption if digital technologies are not made more energy-efficient.[112] However, even if efficiency improves, rebound effects may hamper the expected reduction in energy consumption.[113] These effects consist in an increase in energy consumption and carbon emissions due to a higher overall use of digital technologies,[114] which counterweigh potential energy savings related to the employment of the latter.[115] Energy-efficiency improvements may also contribute to accelerating the accumulation of e-waste, since new digital technologies necessitate replacing hardware that has become obsolete. In this sense, Bertrand argues that the 'Moore's Law' explains the increase of digital devices due to increased computing power.[116] Although the latter may contribute to more environmentally friendly technologies, innovation cycles of digital technologies are progressively shortening, leading to more frequent replacement of digital devices and increasing the overall waste.[117]

Following from the above, the 'highest sustainability standards and innovation' promoted by the European Commission[118] may have a significant (negative) impact on the environment.[119] Rather than minimising the footprint of digital technology, these standards may contribute to increased energy consumption – due to the rebound effect –, require critical raw materials to manufacture devices that are able to keep up with the latest updates, and generate partly hazardous e-waste. As recognized in the 2022 Foresight Report, the digital transition has thus far not adequately taken into account environmental considerations.[120] The lack of common objectives between the green and the digital in the EU pulls apart the twin transitions, leading to what in this chapter we refer to as 'digital insularity'. The digital transition sails a solo course, prioritizing digital sovereignty without considering the green counterpart in the policies and initiatives implementing it.

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[112] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 43), 2.
On the promises of green digital technologies, see also European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions 2030 Digital Compass (n 81), 3 and 19.

[113] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 43) 3.

[114] Though it may refer to any behavioural response to the efficiency improvement that counterweights the expected savings. See European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 3).

[115] See Bertrand (n 57) and The Shift Project, 'Lean ICT: Towards Digital Sobriety' (2019) 429 Futuribles <https://theshiftproject.org/en/article/lean-ict-our-new-report/>.

[116] Bertrand (n 57) 2.

[117] Bertrand (n 57) 2.

[118] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 43) 14.

[119] See, e.g., Alba Perez Victorio, Edoardo Celeste and Alberto Quintavalla, 'Greening AI? The New Principle of Sustainable Digital Products and Services in the EU' (2024) 61 Common Market Law Review <https://kluwerlawonline.com/api/Product/CitationPDFURL?file=Journals\COLA\COLA2024067.pdf>.

[120] European Commission, '2022 Strategic Foresight Report - Twinning the Green and Digital Transitions in the New Geopolitical Context, COM(2022) 289 Final' (n 43) 1.

B. Environmental sovereignism

An adequate consideration of sustainable concerns in the digital context would not only imply an effort towards twinning the two transitions in the EU, but also towards measuring and considering its consequences in non-EU countries. We argue that the impact of the digital transition should be taken into account within and beyond the EU, all the more given the borderless nature of the environment. Although it seems obvious that high carbon emissions in China will contribute to climate change on the overall planet rather than only in China, it seems easy to overlook the impact that EU policies have on these emissions. EU climate neutrality policies following the Green Deal only make sense if they do not generate environmental pressures somewhere else. Failing to consider the effects of EU policies and initiatives beyond its borders would make it impossible for the EU to calibrate its strategies towards digital sovereignty, since these effects may have a boomerang impact on the EU's environmental conditions. Global strategies call for a global perspective.

In this regard, digital insularity is not only related to the compartmentalization between the digital and the green transitions in the EU, but also to the disregard of the global impact of the digital transition: what we could more accurately define as a form of 'environmental sovereignism'. While 'digital sovereignism' has been employed to refer to the adoption by the EU of sovereignist policies that aim to regain digital independence at the expense of third countries, 'environmental sovereignism' would refer to the similar adoption of a 'Europe first' attitude in setting twin transition strategies.

Indeed, the EU does not take into account the environmental effects of its digital policies in non-EU countries. Notably, the EU strategy towards digital sovereignty may create a 'duplication effect': centripetal measures to reshore digital assets to the EU's territory may result in the duplication of data or infrastructure. Indeed, these components of the EU digital infrastructure are not physically moved from other countries to the EU; instead, they are built anew. For example, if data is to be processed in the EU, the establishment of new data centres is required. However, even if the EU adopts higher energy-efficiency standards, the non-EU data centre where data had been processed or stored previously remains operational, thus increasing the total energy consumption.

This seems to be a neglected aspect in the EU agenda. The challenge of data centres has mainly been addressed through a self-regulation mechanism, i.e. the Code of Conduct on Data Centre Energy Efficiency.[121] The Energy Efficiency Directive adopts a similar approach by outlining solely information disclosure requirements, giving owners and operators of data centres the flexibility to adhere to the Code of Conduct.[122] Although mandatory obligations can be found

[121] Mark Acton, Paolo Bertoldi and John Booth, '2022 Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency' (European Commission 2022) JRC128184 <https://e3p.jrc.ec.europa.eu/publications/2022-best-practice-guidelines-eu-code-conduct-data-centre-energy-efficiency>. This document is updated annually.

[122] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 2023, Article 12.

in the Regulation on ecodesign requirements for servers and data storage products,[123] these regard the efficiency of each single data centre, not considering the overall impact of the data centres network, nor taking into account the potential duplication effect.

V. Conclusion: Sustainable sovereignty or digital sobriety?

Promoting sustainable digital technologies in the EU represents a significant challenge. Advocating for sovereign digital policies that foster sustainability on a global scale adds an additional layer of complexity. Specifically centripetal digital sovereignty strategies have an environmental impact in the EU – because of the difficult reconciliation between the green and the digital, mainly due to the rebound effect and Moore's Law – as well as in the global economy – due to, for instance, the duplication effect. Although some of these tensions are acknowledged in the EU, they are not concretely considered by digital policies and initiatives. What in this paper we called digital insularity and environmental sovereignism suggest that, in contrast to the notion of a twin transition, the EU digital sovereignty strategy may not be fully in line with the EU sustainability ambitions.

In response to the issues raised by a non-fully sustainable digital sovereignty in the EU, some have advocated that the turn to the digital should not be automatic. Proponents of digital sobriety suggest that the advancement of the digital transformation should instead be carefully managed, which may imply a voluntary abandonment or moderate use of digital technologies.[124] However, integrating such a narrative in the EU context may face significant obstacles. As Bertrand suggested, the EU discourse on the twin transition integrates environmental objectives with a narrative of progress, exactly to avoid triggering fears of regressing to an 'Amish model'.[125]

Finally, the current geopolitical context should not be overlooked. Indeed, the twin transitions are put forward in a complex landscape shaped by multiple wars in EU neighbouring countries and a persisting energy crisis. EU strategies must thus have a variable geometry, adapting their priorities based on the affordances that will be progressively defined by future challenges.

[123] Commission Regulation (EU) 2019/424 of 15 March 2019 laying down ecodesign requirements for servers and data storage products pursuant to Directive 2009/125/EC of the European Parliament and of the Council and amending Commission Regulation (EU) No 617/2013 (Text with EEA relevance.) 2019 (OJ L).

[124] See, e.g., The Shift Project (n 107); Antoine Amiel, 'Digital Sobriety: How Can We Adapt Our Uses for a Positive Impact on the Environment?' (8 April 2021) <https://epale.ec.europa.eu/en/blog/digital-sobriety-how-can-we-adapt-our-uses-positive-impact-environment>; Céline Péréa, Jessica Gérard and Julien De Benedittis, 'Digital Sobriety: From Awareness of the Negative Impacts of IT Usages to Degrowth Technology at Work' (2023) 194 Technological Forecasting and Social Change 122670.

[125] Bertrand (n 57) 3.