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The Challenges of the EU Twin Transitions: Socio-Economic and Geopolitical Context

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I. Introduction

In the EU regulatory and policy agendas, digitalisation and decarbonisation are seen as ‘twin transitions’. Twin not only in the sense that are occurring at the same time, but also advocating for an integration of the two: digitalisation for decarbonisation and decarbonisation of digitalisation. Indeed, digitalisation possesses a Janus-faced role vis-à-vis the green transition: it can be difficult to achieve efficient decarbonisation without the help of digital technologies, but digital technologies do have environmental implications and their increasingly massive use amplifies energy consumption and has an impact on the exploitation of natural resources. For this reason, it is also assumed that the EU commitment to achieve no net emissions of greenhouse gases by 2050 should pursue economic growth with a sustainable use of resources.

With the advent of the Covid-19 pandemic, Europe has experienced one of the worst socio-economic crises from the end of World War II, more recently amplified by a stark rise of inflation and a related energy crisis generated by the Russian invasion of Ukraine. Yet, the Covid-19 pandemic has allowed the EU to plan and introduce ‘Next Generation EU’, an unprecedented economic initiative, given its massive size and breadth of ambitions. NGEU’s motto ‘for a greener, more digital and resilient future’ well encapsulates the strategic objectives of this measure. Europe aims to recover from the pandemic and foster its economic growth, strengthening at the same time its resilience to climate, energy, health, and digital threats. The NGEU recovery plan supports European Member States to achieve the digital and green transitions together. Within the framework of the European Green Deal, the Commission aims at using data, digital infrastructures and AI solutions to inform the decision-making process in the fight against environmental challenges. However, the recent geopolitical tensions following the Russian invasion of Ukraine and turmoil in the Middle East have provoked an unprecedented energy crisis in the EU, which is now affecting Member States’ economies and potentially undermining pre-established plans and objectives both in the field of digitalisation and green transition.

On top of these ambitions, the EU is racing to achieve technological independence from third countries and foreign multinational companies with the objective of preserving its fundamental rights and strengthening its position as global leader in the digital sector. The recent EU regulatory and policy frameworks in the digital field have been informed by the notion of

¹ We would like to thank Victor Henriquez Diaz and Alba Perez Victorio for their research assistance.

‘digital sovereignty’, a concept which advocates for increasing strategic autonomy of the EU at the level of digital infrastructures, products, services and data. While this strategy seems to be consistent with the EU objectives and ambitions in light of the current geopolitical and economic context, it might represent an additional obstacle to the process of reconciling the digital and green transitions in the Union. Indeed, essential elements of the EU digital sovereignty strategy, such as reshoring components of the digitalisation process to the EU or incentivising the construction of digital infrastructures within the territories of the Member States, imply higher levels of energy consumption, exploitation of water and rare materials as well as waste generation.

This edited volume aims to trigger an academic reflection on the environmental impact of EU digital sovereignty strategies, analysing to what extent the EU has achieved a level of policy coherence that would take into account other domains of action as well as the impact of its ambitions not only within the Union, but also beyond. Such an investigation contributes to current research that is exploring how to effectively reconcile the digital and green transition within the EU by stressing that EU digitalisation strategies are no longer geopolitically neutral, but they aim to achieve technological independence. In this regard, the choice of the new von der Leyen Commission to appoint an executive vice-president with competence on ‘tech sovereignty’ confirms the centrality of this objective for the EU.²

The present book collects contributions of scholars from law, political science, economics and computing. The interdisciplinary approach adopted in this volume is justified by the complex and multifaceted nature of the context from which the core research question of this work stems. An analysis of the compatibility of EU digital sovereignty strategies with the Union’s green objectives cannot be achieved *in abstracto*. It necessarily implies an understanding of the underlying socio-economic and geopolitical context that the Union currently faces. Without ambition of being exhaustive and considering the fast-paced nature of the developments that might affect it, the following section aims to provide an overview of such a context, highlighting in particular the main elements that are challenging the EU twin transition objectives. In light of the complexities characterising the scenario underlying this research, section III illustrates the rationale for adopting an interdisciplinary approach in the context of this work. The chapter will then conclude with an illustration of the structure of the book and a summary of its chapters.

II. The socio-economic and geopolitical context

A. The EU after Covid: from the pandemic to war

The Covid-19 pandemic undoubtedly represented a turning point for the EU. In the aftermath of this sanitary crisis, the then European Commissioner for Economy Paolo Gentiloni convened a High-Level Group on Post-COVID economic and social challenges. In 2022, the Group published a report significantly entitled ‘A New Era for Europe’.³ The pandemic had a significant impact on the EU from a socio-economic perspective.⁴ It triggered a rising inflation,

² EU Commission, ‘College of Commissioners’, <https://commission.europa.eu/about/organisation/college-commissioners_en#:~:text=The%20College%20is%20composed%20of,for%20a%205%2Dyear%20term> accessed 13 December 2024.

³ European Commission. Directorate General for Economic and Financial Affairs., *A New Era for Europe: How the European Union Can Make the Most of Its Pandemic Recovery, Pursue Sustainable Growth, and Promote Global Stability*. (Publications Office 2022) <<https://data.europa.eu/doi/10.2765/11297>> accessed 13 December 2024.

⁴ See Federico Fabbrini and Christy Anne Petit (eds), *Research Handbook on Post-Pandemic EU Economic Governance and NGEU Law* (Edward Elgar 2024).

increased the cost of living, and affected public debt generating fiscal challenges that were possible to face only by suspending standard EU debt rules. Covid-19 exposed the vulnerabilities of European health systems and strained the labour market, creating an overall climate of economic insecurity and declining trust in national and EU institutions.

On the one hand, the pandemic led to an acceleration of already existing trends, such as the advent of remote and more flexible forms of employment, and amplification of existing problems, such as socio-economic inequalities with a higher impact on low-income households, women, and migrant workers. On the other hand, Covid-19 prompted the major institutional reaction at the European level since the end of World War II. The EU adopted the €806.9 billion recovery plan NextGenerationEU, whose central instrument, the Recovery and Resilience Facility, aims to fund strategic areas in order to recover after the crisis and enhance the EU's strength and future resilience.⁵ The pandemic is thus converted in a unique opportunity to transform and modernise the EU, not only in those fields which were directly affected by the Covid-19 sanitary crisis, such as in the area of preparedness and resilience, but also in more general key policy domains, such as research and innovation, digitalisation, common agricultural policy, climate change, biodiversity, and gender equality.

As will be examined in more detail in this Volume, achieving the twin transitions represents a core objective of the EU post-pandemic. Digitalisation is seen as an unprecedented driver of the green transformation, but at the same time there is an increasing awareness of the connatural contradictions of these two policy strategies, given the intrinsic environmental impact of the digital sector.⁶ On top of this challenge, the underlying geopolitical scenario is contributing to add a further layer of complexity. The EU lies in a risky status of dependence from third countries in terms of supply of digital products, services and infrastructures.⁷ Digitalisation for the green transition can no longer be driven by a completely free and open market logic, which would exacerbate the EU's exposure to the ebbs and flows of foreign suppliers. Preserving digital sovereignty – and more generally its strategic autonomy – thus becomes an imperative to guide the EU economic agenda,⁸ and two past experiences act as an important warning for the Union. Firstly, the EU has understood the importance of distancing itself from the two major technopoles, respectively the US and China, in order to avoid being subjects to potential reverberations of their politico-economic arm-wrestling.⁹ Secondly, the pandemic has taught the EU that there might be major global events that can paralyse global supply chains, regardless of geopolitical factors.

⁵ For a critical analysis, see Marco Buti and Sergio Fabbrini, 'Next Generation EU and the Future of Economic Governance: Towards a Paradigm Change or Just a Big One-Off?' (2023) 30 *Journal of European Public Policy* 676.

⁶ See 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).

⁷ See Maximilian Mayer and Yen-Chi Lu, 'Digital Autonomy? Measuring the Global Digital Dependence Structure' (Center for Advanced Security, Strategic and Integration Studies 2022) <<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>>.

⁸ 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).

⁹ Ka Zeng and others, 'Bilateral Tensions, the Trade War, and US–China Trade Relations' (2022) 24 *Business and politics* 399; Xuan-Thao Nguyen, 'Tech Supremacy: The New Arms Race Between China and the United States' (2023) 49 *Articles* 103; Dennis Broeders, Fabio Cristiano and Monica Kaminska, 'In Search of Digital Sovereignty and Strategic Autonomy: Normative Power Europe to the Test of Its Geopolitical Ambitions' (2023) 61 *JCMS: Journal of Common Market Studies* 1261.

The path to EU recovery, however, does not seem to proceed smoothly. The Union did not have the time to ‘breathe’ after the end of the Covid-19 pandemic that a series of wars started at its doorsteps. In February 2022, Russia invaded Ukraine, thus leading to the most serious conflict on European soil since the end of World War II in terms of number of casualties, both military and civilian.¹⁰ October 2023 instead marked the beginning of one of the deadliest war episodes of the longstanding Israeli-Palestinian conflict, which at the time of writing this chapter has not ended and is involving other neighbouring countries, such as Lebanon and Syria.¹¹

The Russo-Ukrainian conflict has triggered a severe energy crisis in Europe.¹² As we will explore in more detail in the next section, the EU was heavily dependent on Russian gas, but the EU Commission decided to impose economic restrictions on trade with Russia, which led to price increases and energy instability in Europe.¹³ Ukraine also represents a major EU provider of wheat, sunflower oil, and corn, whose commercialisation has been proceeding intermittently since the start of the war. The threat of a conflict with Russia in an EU neighbouring country also led to major investments in the defence sector as well as to provide military aids to Ukraine.¹⁴ Moreover, the Russo-Ukrainian conflict has triggered a severe humanitarian crisis with a substantial amount of Ukrainian population fleeing the conflict.¹⁵ Similar issues can be noticed to emerge following the outbreak of the Israeli war against Hamas. Indeed, this conflict is gradually affecting the whole Middle East, generating a climate of uncertainty that affects economic supply to Europe, mainly in relation to oil.

Last, but certainly not least, former President Donald Trump won the US elections in November 2024. Trump’s policy is regarded to be commercially hostile both to China and to the EU.¹⁶ At the time of writing, no specific announcements of the new US economic foreign policy were made, but the lessons learned during the first Trump administration from 2017 to 2021 do not let the EU breathe a sigh of relief, but rather reinforce the urgency of implementing its strategic autonomy strategy, particularly in the digital sector.

B. The EU energy crisis: from geopolitics to climate change

The energy crisis has highlighted the need to reconsider, from a new perspective, the challenges Europe faces in achieving the twin transition. Not only does the European energy market continue to experience significant fluctuations, but the EU also struggles to harmonize immediate energy security needs with long-term objectives of sustainability and digital innovation. The price spikes and uncertainties driven by the energy crisis have created a volatile environment, disrupting both consumer prices and market stability. For instance, gas prices soared by 180% in the early weeks of the 2022 Russo-Ukrainian conflict, with oil and coal

¹⁰ See Paul D’Anieri, *Ukraine and Russia* (Cambridge University Press 2023).

¹¹ See ‘Israel-Gaza War | The Guardian’ <<https://www.theguardian.com/world/israel-hamas-war>> accessed 13 December 2024.

¹² See, e.g., Simone Emiliozzi, Fabrizio Ferriani and Andrea Gazzani, ‘The European Energy Crisis and the Consequences for the Global Natural Gas Market’ [2024] *The Energy Journal*.

¹³ See EU Council, ‘EU Sanctions against Russia Explained’ (*Consilium*) <<https://www.consilium.europa.eu/en/policies/sanctions-against-russia-explained/>> accessed 13 December 2024.

¹⁴ See Igor Pellicciari, *World War Aid: Interventionist Aid and War in Ukraine* (Routledge 2023).

¹⁵ See Marta Dzhus and Iryna Golovach, ‘Impact of Ukrainian- Russian War on Health Care and Humanitarian Crisis’ (2023) 17 *Disaster Medicine and Public Health Preparedness* e340.

¹⁶ See Paul JJ Welfens, ‘Trump’s Trade Policy, BREXIT, Corona Dynamics, EU Crisis and Declining Multilateralism’ (2020) 17 *International Economics and Economic Policy* 563.

prices also experiencing sharp increases.¹⁷ Although prices have moderated in some areas, the energy market remains highly volatile, influenced by factors such as sanctions, shifting supply chains, and the evolving global demand for Liquefied Natural Gas (LNG). The market's sensitivity to external events – such as potential disruptions in LNG supply or extreme weather conditions linked to the current climate change – continues to make energy markets unpredictable.

In response, the European Union has implemented measures to mitigate the impact of rising gas prices on consumers and the economy. For example, Regulation (EU) 2022/2576 introduced a 'market correction mechanism', setting a price ceiling to curb excessive volatility and shield businesses and households from unreasonably high costs.¹⁸ Complementary initiatives include energy-saving campaigns, the promotion of renewable energy, and the creation of strategic gas reserves to safeguard supply during peak demand.¹⁹ Additionally, the EU has accelerated its diversification of energy sources by increasing LNG imports through terminals in various Member States and securing agreements with reliable suppliers such as the United States and Qatar. Enhanced cooperation among Member States has further strengthened the internal energy market, promoting solidarity through shared infrastructure and cross-border interconnections.

This instability reflects not only the immediate effects of geopolitical events but also the broader challenges of transitioning toward cleaner energy. Governments face the difficult task of balancing security and affordability with sustainability goals. Investments in the energy transition and digital sovereignty are critical, yet funding remains a significant bottleneck. While the Recovery and Resilience Facility initially provided crucial support for climate and digital projects, these resources are now largely exhausted. Moreover, regional and social disparities within the EU have deepened. Southern and Central-Eastern Europe, which are more dependent on fossil fuels, encounter greater obstacles in transitioning to renewable energy. Public resistance, exemplified by movements like France's Yellow Vests, highlights the necessity of equitable and inclusive transition strategies.²⁰

Challenges such as grid congestion, financing gaps, supply chain disruptions, and dependency on non-EU suppliers for critical raw materials – like rare earth elements – further expose the vulnerabilities of clean energy pathways. These systemic issues demand immediate attention, as they not only complicate the present energy crisis but also shape the trajectory of Europe's energy future.

C. Digital sovereignty, preservation of democracy and strategic alliances

Interest in sovereignty has re-emerged in recent times as a consequence of the geopolitical crises we are experiencing. These crises have a global and technological component as distinctive features and are becoming evident in war conflicts as well as in new concepts, such as hybrid threats, disinformation, or grey zone. Sovereignty, which is again coming to the fore,

¹⁷ Jakob Feveile Adolfsen and others, 'The Impact of the War in Ukraine on Euro Area Energy Markets' [2022] ECB Economic Bulletin <https://www.ecb.europa.eu/press/economic-bulletin/focus/2022/html/ecb.ebbox202204_01~68ef3c3dc6.en.html> accessed 13 December 2024.

¹⁸ Council Regulation (EU) 2022/2576 of 19 December 2022 enhancing solidarity through better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders.

¹⁹ See Caroline Kuzemko and others, 'Russia's War on Ukraine, European Energy Policy Responses & Implications for Sustainable Transformations' (2022) 93 Energy Research & Social Science 102842.

²⁰ See Mathilde Martin and Mine Islar, 'The "End of the World" vs. the "End of the Month": Understanding Social Resistance to Sustainability Transition Agendas, a Lesson from the Yellow Vests in France' (2021) 16 Sustainability Science 601.

has, however, been transformed into a multi-faceted concept encompassing several interrelated aspects: economics, technology, politics and human rights.²¹ In the 21st century, globalisation, internationalisation, and the influence of private powers, show a tension that undermines state effectiveness in this context. As a result, international and supranational communities are more successful, as individual states lack the capacity to address and control the challenges posed by globalisation and digitalisation, opting instead to cede part of their sovereignty to institutions such as the European Union.

In this context of international, political and diplomatic crises, technological-digital sovereignty emerges as a vital component of geopolitical competition.²² The rapid evolution of digital technology has a significant impact on the global economy, society and politics, generating key geopolitical implications. Competition between states for technological leadership emerges as a prominent political consequence, as those with a robust technology sector gain competitive advantages, develop new technologies and attract foreign investment. Moreover, the increasing reliance of states on digital technology, essential to the functioning of the economy, society and government, presents another crucial geopolitical implication. States without a robust digital infrastructure become vulnerable to technological threats and attacks, underlining the strategic importance of digital capability.

Digital sovereignty has become a fundamental pillar in the defence of democracy in an increasingly interconnected world dependent on digital technologies.²³ In this sense, digital sovereignty implies the ability of each state to control its own digital space, protect its data and secure its critical infrastructures against cyber threats that cross borders, and guarantee the fundamental rights and freedoms of its citizens. Moreover, the threats to this sovereignty posed by cyberattacks, disinformation and vulnerabilities in critical or strategic infrastructures underline the need for common policies, such as those promoted by the European Union, which seek to achieve both digital self-sufficiency and strategic alliances to face global threats with democratic states.

It is clear that, by promoting digital sovereignty, the EU advocates technological humanism and the defence of human rights, establishing a normative framework in response to power confrontations between China and the United States.²⁴ Likewise, Europe seeks an alliance with the US in situations involving the defence of human rights or when it perceives threats to its security. This was evidenced by the US-EU Trade and Technology Council in September 2021 denying access to technologies such as artificial intelligence, 5G, chips and certain software to governments that do not respect human rights or pose risks to national security.²⁵ From an economic perspective, this approach has led to a push towards self-sufficiency and protectionism as countries such as China and Russia develop their capabilities and seek to influence strategic areas for their technological development. Thus, we are confronted with protectionism and self-reliance, strategic alliances and diversification.

²¹ See Julia Pohle and Thorsten Thiel, 'Digital Sovereignty' (2020) 9 *Internet Policy Review* <<https://policyreview.info/concepts/digital-sovereignty>> accessed 2 May 2024; Broeders, Cristiano and Kaminska (n 8).

²² On this point, see Santaniello and Alvarez Robles in this Volume.

²³ From an EU perspective, see Celeste (n 7); 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).

²⁴ Cf. Edoardo Celeste and Giovanni De Gregorio, 'Digital Humanism: The Constitutional Message of the GDPR' (2022) 3 *Global Privacy Law Review* 4.

²⁵ 'EU-US Trade and Technology Council Inaugural Joint Statement' (*European Commission*) <https://ec.europa.eu/commission/presscorner/detail/pl/statement_21_4951> accessed 13 December 2024.

In the face of this technological-digital tension, the EU is acting on multiple fronts: strengthening a European digital power by leading its own projects, such as Gaia-X;²⁶ further developing its digital regulatory framework, focusing on technological humanism; and creating more strategic alliances with democratic states. The ideal vision for Europe involves having its own technologies and capabilities while maintaining links with like-minded states, following what has been called ‘open strategic autonomy’.²⁷

A further challenge of digital sovereignty lies in the urgency of establishing clear regulations that delimit responsibilities, rights and protocols for action in cyberspace, as well as a coordinated policy commitment in this area. Meeting this objective also means investing in cyber diplomacy: negotiating international agreements and creating cooperation frameworks that guarantee digital security, while respecting the sovereignty of each nation.²⁸ Cyber diplomacy should promote global standards of protection and ensure a common response to threats, fostering mutual trust and reducing the risks of cyber conflicts that escalate into geopolitical tensions.

III. The need for interdisciplinary research

This complex reality, evident when the theme of the Summer School that inspired this book was first conceived, holds even greater urgency and relevance today. In addressing such a complex and evolving issue, it seemed essential to integrate perspectives from diverse disciplines – law, political science, economics and computing – to provide a comprehensive analysis and deepen our understanding of the challenges and opportunities in this critical field.

The legal framework underpinning the EU’s twin agenda is multifaceted, and the pursuit of the environmental and social objectives underlying the twin transition has revealed the inadequacy of the traditional economic regulation approach historically adopted by the European Union in the energy market. The energy crisis has further emphasized the need for the EU to move beyond its role as a mere regulator and assume a more proactive, strategic stance, requiring not only regulatory reform but also decisive interventions to ensure energy security, foster technological innovation, and address social and environmental equity. This shift marks also the evolution from the European Regulatory State to a new EU industrial policy. This evolution has likely contributed to the growing emphasis on the concept of sovereignty at the European level. Initially discussed primarily in the context of digital sovereignty, the notion of European sovereignty has increasingly expanded to include a more diffuse concept of energy sovereignty. The connection between these two forms of sovereignty – digital and energy – is one of the key issues to be explored in this volume.

Politically, the energy crisis has exposed the fragility of EU solidarity.²⁹ While mechanisms like the Energy Union aim to promote cohesion and ensure equitable access to resources, diverging national interests often complicate collective decision-making. For instance, debates

²⁶ See Simona Autolitano and Agnieszka Pawlowska, ‘Europe’s Quest for Digital Sovereignty: GAIA-X as a Case Study’ (Istituto Affari Internazionali (IAI) 2021) <<https://www.jstor.org/stable/resrep30940>> accessed 13 December 2024.

²⁷ See Luuk Schmitz and Timo Seidl, ‘As Open as Possible, as Autonomous as Necessary: Understanding the Rise of Open Strategic Autonomy in EU Trade Policy’ (2023) 61 *Journal of common market studies* 834.

²⁸ See Amel Attatfa, Karen Renaud and Stefano De Paoli, ‘Cyber Diplomacy: A Systematic Literature Review’ (2020) 176 *Procedia Computer Science* 60.

²⁹ See Michael Carnegie LaBelle, ‘Breaking the Era of Energy Interdependence in Europe: A Multidimensional Reframing of Energy Security, Sovereignty, and Solidarity’ (2024) 52 *Energy Strategy Reviews* 101314; Kaisa Huhta and Leonie Reins, ‘Solidarity in European Union Law and Its Application in the Energy Sector’ (2023) 72 *International & Comparative Law Quarterly* 771.

around the distribution of resources from the Social Climate Fund have highlighted tensions between wealthier and less affluent Member States. Moreover, the crisis has reignited discussions about the role of nuclear energy within the EU's energy mix, with countries like France advocating for its inclusion as a sustainable option, while others remain sceptical.

Economically, the transition demands unprecedented levels of investment in infrastructure, technology, and workforce development. The European Investment Bank has estimated that achieving the Green Deal objectives will require annual investments of €350 billion by 2030, a figure that significantly outpaces current spending levels.³⁰ This financial gap underscores the importance of mobilizing private capital, facilitated by instruments like the InvestEU program and green bonds. However, market fragmentation and regulatory uncertainty pose barriers to investor confidence, necessitating clearer policy signals and enhanced risk-sharing mechanisms.

The digital dimension of the EU's agenda is equally critical, given the synergies between technological innovation and energy efficiency. Initiatives like the Digital Europe Programme and the European Chips Act aim to bolster the EU's digital sovereignty, reducing reliance on external suppliers and fostering homegrown innovation. Smart grids, blockchain-based energy trading platforms, and AI-driven optimization tools are increasingly seen as enablers of a more resilient and sustainable energy system. However, these technologies are not without drawbacks, as they tend to be energy-intensive themselves. Blockchain, in particular, is known for its high energy consumption, largely driven by the computational demands of consensus mechanisms like proof-of-work used in many applications. These mechanisms require significant processing power, contributing to substantial carbon emissions, especially when powered by non-renewable energy sources. Similarly, the computing power required for AI-driven applications in smart grids and other energy platforms often results in considerable energy use, potentially offsetting the sustainability benefits they aim to deliver.³¹

IV. Structure of the book

The book is divided into three parts. Part I critically assesses the aims of EU digital sovereignty ambitions, examining the issues that the new regulatory framework proposed to address these objectives may have in reaching their full potential both from a legal and from a technical perspective. This analysis will be complemented by multidisciplinary contributions exploring transnational implications of EU digital sovereignty in light of the current geopolitical context. Part II of the book tackles the core research question of this project by assessing the compatibility of EU digital sovereignty ambitions with the green transition agenda. This part aims to challenge the vision of digitalisation and climate change mitigation seen as two harmonious twin transitions, highlighting both points of convergence and existing tensions. The contributions of this part explore the environmental impact of EU digital sovereignty ambitions and dive into case studies that simultaneously show the complementary role of digitalisation in the quest for energy autonomy and in achieving a better data driven policymaking and management of the public good. Part III contextualises the issues analysed in the first two parts of the book by assessing to what extent the integration of disruptive technologies 'made in the EU', which is supported and encouraged by EU digital sovereignty

³⁰ 'Keynote Address by EIB President Werner Hoyer at B20 Summit Focusing on Climate Finance, "Delivering Climate Finance: No Time to Waste"' (*European Investment Bank*) <<https://www.eib.org/en/press/speeches/delivering-climate-finance-no-time-to-waste-hoyer>> accessed 13 December 2024.

³¹ See 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*.

strategies, can strengthen the EU digital economy while having a sustainable impact. The contributions of this part adopt a special focus on the use of blockchain technologies, questioning the compatibility between their sovereign ambitions and their environmental sustainability. This part also includes an analysis of the new EU Declaration on Digital Rights and Principles, which enshrines a specific chapter on digital sustainability that might inform future regulation of these disruptive technologies. These considerations are further complemented by an examination of the role of the banking system in promoting and stabilising digital sovereignty and environmental good practices in the use of these technologies.

Part I of the book analyses the EU digital sovereignty strategies, focusing on their ambitions, technical challenges and extraterritorial effects. It sets the framework for the discussion that will be developed in the following two sections. Chapter 2, entitled *EU Digital Sovereignty: Regulatory and Policy Ambitions* and written by Brunessen Bertrand, opens Part I of the volume. European digital sovereignty refers to sovereignty in reverse, i.e. to the idea that state sovereignty is challenged in many ways by the digital transition, and that only the European scale can limit, and perhaps correct, these attacks. States are faced with digital platforms or foreign powers that have the means to be not only their equal, but perhaps also their superior and competitor. The conceptualization of European digital sovereignty does not consist in projecting the theory of the State to the European level, but in thinking about the independence, or even the empowerment, of European public power, in a global situation in which it has not been able to find its place: giving back to European States the capacity to act in a world reconfigured by digital technology.

In Chapter 3, Harshvardhan J. Pandit, in a contribution entitled *Technical Challenges for EU Digital Sovereignty: Lessons from the GDPR*, focuses on the technical feasibility of the current regulatory strategy of the EU in the digital field, which represents the foundation of the quest for digital sovereignty. Several new regulations have been adopted at EU level to address the use of digital technologies and services. While such advances are a positive development, they also raise the broader question of how such EU acts ‘fit’ or ‘work’ together - and whether there is a risk of failure to reach their potential. This chapter provides an investigation on this question by utilising the experience of regulating technologies through the General Data Protection Regulation (GDPR) to identify limitations and challenges that are likely to arise individually and collectively in the application of the Data Governance Act (DGA), Digital Services Act (DSA), Digital Markets (DMA), as well as the AI Act. It concludes with the necessity to develop new modalities and mechanisms that complement the existing legal frameworks to also make these laws ‘digitally enforceable’ also through what the author defines a ‘reactive techno-regulation’ so as to address the scale and scope of progressive technologies.

Chapter 4, written by Tamara Álvarez Robles and entitled *Digital Sovereignty, Cybersecurity and Geopolitical Implications*. Álvarez articulates her chapter in three intertwined logical steps. Firstly, she examines the various conceptions and meanings of digital sovereignty in the EU context. In particular, highlighting a divergence of policy and regulatory strategies depending on the notion of digital sovereignty adopted. Secondly, the chapter contextualises EU digital sovereignty claims in the existing cybersecurity regulatory framework, presenting a comparison of the EU and Spanish systems. The third part of the chapter broadens the horizons of the investigation by projecting cybersecurity implications of EU digital sovereignty claims in the global context. The current geopolitical scenario is examined to highlight emerging dependencies and tensions among block of States at international level.

Chapter 5, authored by Mauro Santaniello and entitled *Digital Sovereignty in the Euro-Mediterranean Region: Protection and Competition in an Interconnected World*, closes the

first part of this book. Santaniello analyses how the European discourse on digital sovereignty is affecting EU relationships with its Southern neighbourhood. Building upon constructivist theories of sovereignty, the chapter advances a conceptualization of digital sovereignty as an adversarial and multiversal discursive resource, and analyses how this framework has been developed by EU institutions in relation to EU's Southern neighbourhood partner countries. The chapter also analyses how the European discourse on digital sovereignty has been received and reformulated by North African countries and by regional organisations operating in the Mediterranean area. The analysis highlights contradictions and tensions between different understandings of digital sovereignty, and their possible implications for the geopolitical relationships between the European Union and its Southern partners.

Part II tackles the core research question of the volume by assessing the compatibility between EU digital sovereignty ambitions and its green transition agenda. In Chapter 6, Edoardo Celeste and Alba Perez Victorio open this part with a contribution entitled *Sustainable Digital Sovereignty? Environmental Impact of EU Tech Strategies*. The chapter identifies two types of approaches embraced by EU digital sovereignty strategies. The first one is called 'centrifugal' and consists in trying to extend EU standards beyond its borders; the second one is defined 'centripetal' as it encourages the reshoring of a digital industry to 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, generating a significant ecological footprint. 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.

Chapter 7, entitled *Fostering the EU Energy Transition through Participatory Digital Sovereignty* and written by Tamara Favaro, builds on Celeste's contribution by reflecting on the relation between EU energy autonomy strategies and digital sovereignty in the EU. This chapter is articulated in two parts. The first one (sections II and III) aims to reconstruct the concept of European energy sovereignty considering the evolution of EU energy law, emphasizing its implications in the context of public intervention modes within the economy. The second part (sections IV and V) focuses instead on the contribution provided by emerging digital technologies, and in particular blockchain, to achieve European energy sovereignty, understood as a participatory process aimed at accomplishing the energy transition. Blockchain's potential lies in its ability to decentralize critical sectors like energy, giving local actors more control and reducing reliance on centralized, often foreign-owned systems. This supports the EU's ambition for digital sovereignty by creating more autonomous, transparent, and secure digital ecosystems that are not subject to the control of external powers. By enabling decentralized energy platforms, blockchain promises to play a pivotal role in both the energy transition and the broader digital sovereignty agenda of the EU, empowering citizens and local entities while reducing the influence of foreign tech giants.

In Chapter 8, entitled *Government as an environmental platform: Digital sovereignty and data-driven environmental action*, Thibault Carrère analyses the emergence of a new type of public environmental action. The purpose of this study will be to show how the French "Government as a platform" policy, through the intermediary of the agency for ecological transition (ADEME) and the state startup DATAGIR, by producing and disseminating a massive amount of environmental data, is attempting to guide the behaviour of individuals and the creation of new services that are key to the ecological transition. This new organisation would make it possible to emancipate member states from foreign private players and thus strengthen their

digital sovereignty. In this context, digital sovereignty, far from being incompatible with the ecological transition, could well be a driving force behind it.

Chapter 9, by Pierre-Henri Morand and entitled *Digital sovereignty and green public procurement* closes Part II of the book, examining the policies and practices of procurement of digital products or services by public administrations. By virtue of EU law and free trade agreements, public procurement does not allow the pool of companies eligible to bid to be restricted or the nationality of companies awarded contracts to be controlled. The issue of sovereignty as perceived by public authorities is essentially a matter of domestic protectionism, and environmental criteria are mobilised as an instrument of sovereignty. The strategies proposed by governments to defend digital sovereignty echo those related to the sustainability of public procurement. Morand analyses Tender Electronic Daily data (award notices published in the Supplement to the EU Official Journal) to assess the link between digital sovereignty and environmental criteria, and to understand its limitations. The study examines statistical data pertaining to all European public procurement award notices, with a particular focus on France as a case study. The chapter demonstrates how the pursuit of sovereignty in public procurements often involves environmental considerations, although procedures related to digital products and services do not necessarily rely on sustainability requirements to pursue digital sovereignty objectives, rather using other factors related to national sovereignty.

Part III of the book discusses how the production and use of disruptive technologies made in the EU, which is supported and encouraged by EU digital sovereignty strategies, can strengthen the EU digital economy while having a sustainable impact. In Chapter 10, the contribution by Gaël Depoorter entitled *Bitcoin: a subversive model of sovereignty undermined by the climate challenge?* analyses the sovereigntist ambitions of Bitcoin and its environmental implications. In 1998, John Perry Barlow published a manifesto in which he declared the independence of cyberspace. Ten years later, Bitcoin, backed by blockchain technology, perpetuated this utopia by proposing to take a decisive step towards it. Bitcoin is seen as a currency that can free itself from the social and political constraints of the 'old world' and is commonly presented by its advocates as a genuine alternative to the monetary and political sovereignty of states. However, this paper questions to what extent the environmental impact of Bitcoins' mining makes it truly feasible to realize these cyber-sovereigntist ambition. The chapter will rely on the observation of numerous meetings, gatherings and workshops of activists and entrepreneurs during different editions of Surfin' Bitcoin (the most important European event around Bitcoin), as well as on a virtual ethnography of the 'crypto community' on Twitter and Telegram.

Chapter 11, written by Cecilia Rasetto, builds on Depoorter's contribution and focuses on the positive effects on the implementation of blockchain technology in the agri-food sector. Her piece entitled *Blockchain for sustainability: the case of agribusiness* reflects on how agri-food systems' risk are compromising sustainable development, with an inevitable impact on integrity and biodiversity in terms of loss of genes, species, habitats, ecosystems and simplification of the landscape, while trying to meet growing global needs. One strategy deemed suitable to limit this phenomenon consists in adapting blockchain technology to agri-food. Blockchain is a functional tool for acquiring and storing data, which if applied to the agri-food sector would be able to record and store the entire food production cycle; concretely, it would enable a positive response to the needs for transparency, traceability and certification. However, at the same time, the chapter explores the negative impact of blockchain use on the environment. Since blockchain is also one of the so-called energy-consuming technologies the chapter attempts to offer concrete answers to both questions while keeping in mind the protection of the environment for present and future generations.

Chapter 12 by Alba Perez Victorio and Edoardo Celeste is entitled *Eco-Digital Products and Services: Towards New EU Sustainability Rights?* and examines the contribution of the new EU Declaration on Digital Rights and Principles to shape and recognise new sustainability rights and principles in the digital environment. Perez and Celeste analyse the chapter of the Declaration on digital sustainability, focusing on its legislative history and subsequent amendments. They argue that this new text does not recognize a new right to a healthy environment in the digital society, but rather enshrines a principle of sustainable digital products and services. The novelty of this principle is then examined positing that the uniqueness of the Declaration lies in making the principle of sustainable products and services explicit through an operation of normative retrofitting that reconstructs a guiding principle of already existing EU and member state regulatory and policy strategies. Finally, the chapter contextualises this new principle within the EU digital and environmental policy framework, questioning the feasibility of its ambitions starting from the assumption that even a virtuous digitalisation may negatively affect the environment. The authors refer to theories of digital sobriety and degrowth, ultimately arguing that the reconciliation between the twin transitions in the Declaration is unavoidably only partial.

Chapter 13, entitled *Digital Sovereignty and ESG Policies: The Role of the Banking System* by Francesco Dimichina closes the third part of the book. Firstly, with the Banking Union and, secondly, with Next Generation EU (NGEU), the EU is strengthening its integration in spite of the phenomenon of 'slowbalization'. NGEU makes it possible for the EU Commission to raise resources to be invested in transnational political priorities, first of all in the green and digital transition. As regards the digital transition, it is necessary to preserve 'digital sovereignty', especially because European data is mostly processed and stored by foreign companies. As this risk concerns also the banking system, in November 2022 the European Central Bank (ECB) joined the European data and cloud network initiative, Gaia-X. Regarding the green transition, Environment, Social and Governance (ESG) policies have reached an increasing relevance in the exercise of banking activity. The chapter examines the European Banking Authority (EBA)'s roadmap on sustainable finance and reflects on how the need to preserve digital sovereignty and the ESG policy related to the banking system may promote the success of European integration, despite the Janus-faced role of digital technologies vis-à-vis the environment.