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Climate Breakdown as a Systemic Risk in the Digital Services Act

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#DSA, #DigitalServicesAct, #Sustainability, #ClimatePolicy, #DigitalGovernance

Digital technologies have substantial environmental impacts. The EU's 2022 Digital Services Act (DSA) requires the largest platforms and search engines to regularly assess "systemic risks" to various social interests – including public health, physical wellbeing, security, and fundamental rights – and to reasonably and proportionately mitigate these risks. Climate change and other escalating environmental crises severely threaten these interests. Accordingly, this policy brief argues that the DSA requires these companies to take reasonable measures to reduce their environmental impacts.

This should notably include following best practices to minimise energy and water usage, including "sustainability by design" obligations to pursue less energy- and resource-intensive technologies, design choices, and business practices wherever possible. It should also include measures addressing platforms' indirect environmental impacts, such as the facilitation of environmentally-damaging behaviour by third-party businesses. Since the DSA's risk mitigation obligations apply specifically to the largest platforms – which exercise significant influence over broader technological and commercial ecosystems – regulatory pressure on these companies to take such measures could have outsized environmental benefits.

The policy brief offers a legal analysis of the DSA's relevance to environmental policy and explains why environmental risks are within its scope. It then outlines appropriate measures to mitigate platforms' direct and indirect environmental impacts. It concludes with recommendations for platform companies, regulators, and civil society on how to realise the Digital Services Act's potential to help secure a more sustainable tech industry.

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1 Introduction

Digital policy and climate have been identified as the two "meta-policies" defining the current EU Commission's agenda (Grabbe, 2021). Maybe surprisingly, then, the 2022 Digital Services Act/Digital Market Act package draws few connections between the two. The words "sustainable", "sustainability" and "climate" do not appear in either text. "Environment" and "ecosystem" appear only in phrases like "platform ecosystem" and "online environment". Yet online environments are not some kind of intangible parallel universe, but energy-intensive material systems which directly impact the "offline environment" that is rapidly spiralling into climate breakdown (IPCC, 2023).

The information and communication technology (ICT) sector is thought to contribute between 1.8 and 3.9% of global emissions (Freitag et al., 2021). This will likely continue increasing, given growing demand for ICT services and the rapid advancement and commercialisation of energy-intensive machine learning technologies (Freitag et al., 2021; Kaack et al., 2022; Hacker, 2023). Reducing these emissions – as well as other environmental impacts, such as water use – should be integral to the EU's sustainability and digital policy programmes.

Current legislative proposals including the AI Act and Corporate Sustainability Due Diligence Directive could help achieve this, although experts have highlighted necessary improvements (Hacker, 2023; Eller, 2023). However, the Digital Services Act (DSA) also offers some promising regulatory tools – and, unlike the aforementioned proposals, is already in force. Yet so far, there has been almost no attention in research and policy literature to the DSA's environmental policy implications.

This policy brief therefore analyses the potential for environmental considerations to play a major role in DSA implementation. It shows that emissions, water consumption, and other direct and indirect environmental impacts are within the scope of Articles 34-35 DSA, which require the largest platforms to take reasonable measures to mitigate broadly-defined systemic risks. It then highlights key areas where these obligations could require platforms to reduce their environmental impacts. It concludes with recommendations for platforms, regulators, and civil society to prioritise sustainability in implementing the DSA.

Regulators, companies, and other stakeholders are currently gearing up for DSA implementation – hiring staff, issuing delegated acts and policy guidance, and setting up oversight and compliance structures. This is a critical window of opportunity to ensure that sustainability measures receive the attention they deserve. If that succeeds, the DSA can make a small but significant contribution to the society-wide emissions cuts that are necessary to achieve the EU's climate policy goals.

2 Why the DSA?

Any regulatory framework that (dis)incentivises the use of technologies or business practices has sustainability implications – and given the gravity and urgency of the climate crisis, sustainability should be a priority in every regulatory field. However, beyond these general points, three reasons make the DSA especially relevant. First, it is already in force. Second, it has a wider scope than other relevant legislation. And finally, it targets companies with significant environmental impacts and industry-wide influence.

Immediate effect

Unlike the AI Act and Corporate Sustainability Due Diligence Directive, the DSA is already in force and fully applicable from early 2024 (ten Thije, 2022). Not only are we in an escalating environmental crisis, we are also seeing rapid technological developments – notably in AI – that could create path dependencies shaping the tech industry for decades. The DSA offers regulatory tools that are available immediately and could shape long-term technological developments in a more sustainable way.

Moreover, even when the Corporate Sustainability Due Diligence is in force, linking its broad standards to other regulatory frameworks and legal obligations – like the DSA – will be important for "moving beyond a box-checking exercise" (Mak, 2022, p3).

Scope

In current AI Act proposals, key reporting and risk mitigation obligations only cover AI tools in specific high-risk sectors (for the latest draft see European Parliament, 2023; for a detailed discussion, Hacker, 2023). In contrast, Articles 34-35 of the DSA are broader in two key respects. First, they apply at the level of services rather than specific tools. Second, they encompass a broader range of business practices.

Specifically, Articles 34-35 apply to online platforms (defined in Article 3(i) as hosting services disseminating user-generated content to the public) and search engines (defined in Article 3(j) as services allowing users to search the web for results relating to a keyword or other input) which have over 45 million EU users ("very large online platforms" and "very large online search engines", hereafter VLOPs/VLOSEs). VLOPs/VLOSEs are required to assess and mitigate "systemic risks" in various broadly-defined areas associated with "the design or functioning of their service and its related systems, including algorithmic systems, or from the use made of their services".

Referring to the functioning and use of services indicates that this encompasses risks relating not only to specific technological systems, but to the broader operations of platforms and search engines in their business and social context. As section 4(b) discusses, this could include aspects with significant climate impacts – such as policies regulating third-party business users – which might not be covered by the AI Act's focus on individual AI systems.

Focus on key gatekeepers

Finally, since Articles 34-35 focus on the largest platforms, they target some of the companies with the greatest influence on the broader tech sector and global value chains. In contemporary digital industries, the provision of key infrastructural services (such as cloud computing, operating systems, search, and maps) is dominated by a few "big tech" companies. They offer access to broader ecosystems of smaller companies that rely on and/or offer complements to their platformised services. Consequently, they have significant power to regulate other companies' business practices. Emerging AI technologies appear to be developing under a similar platformised model (Srnicek, 2022).

So far, the following platforms have been designated as very large online platforms or search engines (VLOPs/VLOSEs) under the DSA, and are therefore subject to its risk mitigation obligations: AliExpress; Amazon Store; Apple's App Store; Microsoft's Bing and LinkedIn; Booking.com; Meta's Facebook and Instagram; Google's Maps, Search, Shopping and Play app store, as well as YouTube (also owned by Google); Pinterest; Snapchat; TikTok; Twitter; Wikipedia; and Zalando. This doesn't cover all of the most influential infrastructural services (since it focuses on consumer-facing platforms and thus excludes, for example, cloud providers) but does include many of them. That makes it highly relevant to ask how the DSA could induce these companies to implement more sustainable practices, because their design and governance choices have ripple effects throughout the tech sector.

3 Environmental impacts as systemic risks

No risk to society is more severe or systemic than the unfolding climate emergency. Avoiding unpredictable tipping points and catastrophic environmental breakdown requires rapid emissions reductions across all sectors, including tech (IPCC, 2023). At the same time, many other environmental systems are in crisis: a recent review found that seven out of eight "Earth system boundaries" for our society's sustainable continued existence have already been exceeded (Rockström et al., 2023). This notably includes the water system, which is significantly impacted by the water consumption of ICT infrastructure (Mytton, 2021; Brissy et al., 2023; Hernanz Lizarraga & Solon, 2023).

In this context, are very large platforms obliged to address their environmental impacts under Article 35 DSA, which requires them to mitigate systemic risks? "Systemic risk" is not explicitly defined in the DSA, but Article 34(1) specifies that VLOPs/VLOSEs must assess "any systemic risks in the Union" stemming from the design, functioning, and use of their services, including the following:

- dissemination of illegal content
- negative effects on **fundamental rights**
- negative effects on civic discourse, electoral processes, and **public security**
- negative effects related to gender-based violence, **public health, protection of minors, and people's physical and mental wellbeing**

Climate and sustainability are not expressly mentioned. However, several of these areas are significantly and directly affected by climate impacts that are already affecting the EU – from the 2022 heatwaves that caused over 60,000 deaths in Europe (Niranjan, 2023) to other extreme weather like floods (Lehmkuhl et al., 2022) or drought and its long-term impacts on agriculture (Toreti et al., 2023). This most obviously includes those highlighted in bold above: public health, physical wellbeing and security, as well as fundamental rights. According to many legal scholars, EU fundamental rights and international human rights law require the state to take positive action on climate change, and should be interpreted in line with environmental protection goals (Venn, 2019; Morgera and Martin-Duran, 2021). Such interpretations have been upheld by the Dutch and German supreme courts.[1]

[1] *Neubauer v. Germany* [2021] was based on domestic constitutional rights and *Urgenda v. Netherlands* [2019] on the European Convention of Human Rights. Article 52 of the EU Charter of Fundamental Rights stipulates that Charter rights should provide at least the same level of protection as the Convention and should be interpreted in harmony with national constitutional traditions. Thus, these national decisions provide strong support for interpreting EU fundamental rights as mandating environmental protection.

Surprisingly, then, given their relevance to several risks mentioned in Article 34, so far there has been virtually no discussion of potential DSA obligations to assess and mitigate environmental risks.[2] Corporate due diligence and risk mitigation are not, by themselves, a sufficient policy response. However, since the climate emergency requires us to pursue "every feasible emission cut that can be achieved anywhere" (Welton, 2023), they can be part of the picture. Tech sector emissions are significant and growing. And given VLOPs/VLOSEs' scale and influence – by definition, their services reach at least 45 million consumers, and many provide infrastructure for numerous businesses across the economy – inducing them to make even relatively small changes could meaningfully contribute to reducing overall emissions. Two specific areas can be highlighted which fall within the scope of Articles 34-35 of the DSA and where VLOPs/VLOSEs' business practices have substantial environmental impacts.

Direct impacts of digital technologies

The first is the direct environmental costs of digital technologies. "Virtual" environments are built on a very material infrastructure of servers, data centres, and end-user devices. By 2030, data centres are predicted to represent 3.2% of EU electricity consumption (DG Energy, 2020) – a greater share than the entire country of Belgium (IEA, 2020). They also entail significant water consumption, mining, and pollution (Crawford ,2021; Lehuedé,2023; Hacker, 2023).

Current industry trends suggest that – in the absence of regulatory intervention – these impacts will only increase (Freitag et al., 2021; Arcep, 2023). This notably includes the rapid integration of generative AI technologies into search engines, social media, and other applications, and the push by leading tech companies including Meta and Apple to develop and commercialise immersive virtual reality products. Both technologies use very substantial computing power, meaning their rollout by leading tech companies implies significantly increased energy and water use (Stoll et al., 2022; Luccioni, 2023).

Indirect impacts of platform business models

Platforms also indirectly contribute to environmental impacts through their influence on consumer behaviour and other organisations' business practices. Of the 19 platforms currently designated as VLOPs/VLOSEs, ten are funded wholly or primarily by advertising and four are e-commerce sites (some advertising-funded platforms like Facebook, Instagram, and TikTok are also increasingly diversifying into e-commerce). As such, most VLOPs/VLOSEs are basically incentivised to encourage as much consumer spending as possible. This necessarily implies greater energy use, resource consumption, and pollution (Lell, 2023), and undermines the EU's policy goal of a circular economy (European Commission, 2023a).

Arguably, business models centred on "generation of artificial needs" are incompatible with environmental policy goals (Landwehr et al., 2022, p4). Yet even within the parameters of their existing business models, as section 4(b) shows, there is plenty of scope for VLOPs/VLOSEs to discourage environmentally damaging practices by third-party users and reduce their indirect environmental impacts.

[2] This excepts some occasional discussion of climate-related online misinformation (e.g., CAAD, 2023), which – as this section makes clear – is not the most significant way in which major tech platforms impact the environment.

4 Mitigating environmental risks in the DSA

Since these direct and indirect environmental impacts pose systemic risks to several of the public interests mentioned in Article 34(1), VLOPs/VLOSEs are obliged to "diligently identify, analyse and assess" how the design, functioning, or use of their services could contribute to those risks. Risk assessments must be carried out once a year, "and in any event prior to deploying functionalities that are likely to have a critical impact on the risks identified". Platforms must "put in place reasonable, proportionate and effective mitigation measures", and have their risk assessments and mitigation measures independently audited (as set out in Article 37 DSA and in the Commission's forthcoming delegated legislation: European Commission, 2023b).

How could risk assessment and mitigation look in practice? The DSA envisages a potentially very wide range of approaches, though more detailed standards can be specified through delegated acts, regulatory guidance, and codes of conduct (Jaursch, 2022). Article 34(2) provides that risk assessments should consider the following factors (those particularly relevant to mitigation of environmental impacts are here highlighted in bold):

- **the design of any relevant algorithmic systems**
- content moderation systems
- applicable terms and conditions and their enforcement
- **systems for selecting and presenting advertisements**
- **data-related practices**
- intentional manipulation of services
- amplification and dissemination of content which is illegal or violates terms and conditions

Article 35(1) provides that mitigation measures "may include, where applicable":

- **adapting the design, features, or functioning of services**
- adapting terms and conditions and their enforcement
- adapting moderation processes
- **testing and adapting algorithmic systems**
- **adapting advertising systems, including targeted measures to limit or adjust the presentation of advertisements**
- **reinforcing internal processes, resources, testing, documentation, or supervision of any activities, in particular regarding detection of systemic risks**
- cooperating with trusted flaggers and out-of-court dispute settlement bodies
- **cooperating with other providers through codes of conduct and crisis protocols**
- awareness-raising measures and providing information to users
- age verification, parental controls, and other child safety measures
- flagging artificially generated or manipulated content

Article 35(1)'s list of examples is non-exhaustive, so other environmental protection measures could also be appropriate. In any case, the references to adapting the design, features, and functioning of services and testing, documenting, or changing internal processes are already extremely broad, and there are many appropriate and effective mitigation measures falling within the highlighted areas.

The following subsections highlight some concrete measures that could significantly reduce VLOPs/VLOSEs' consumption, emissions, and other direct and indirect environmental impacts. This should include both reducing their own direct energy and resource use, and reducing indirect impacts of their business models by encouraging more sustainable practices by other actors in platform ecosystems.

4.1 Mitigating direct impacts

Renewable energy

One measure to mitigate direct emissions could be building data centres and other infrastructure in locations where they can use more renewable energy. Indeed, this is something many leading platform companies already claim to do (Stoll et al., 2022). The DSA might incentivise them to increase these efforts.

However, cutting overall energy use is still essential (Freitag et al., 2021). First, renewable energy still has environmental impacts, and given the imperative to decarbonise the whole economy as fast as possible, any unnecessary use of energy for data centres takes away renewable capacity that is needed elsewhere (Kazansky et al., 2022). Second, digital infrastructure has other environmental impacts beyond energy use, notably including water consumption (Mytton, 2021; Hernanz Lizarraga & Solon, 2023). As renewable energy will often be most abundant in dry regions with high solar capacity, relocating data centres can create difficult tradeoffs with water scarcity (Hacker, 2023).

Computing resources

This implies that risk mitigation measures must also include using less resource-intensive technologies, for example choosing tools that use less computing power (and thus less energy and water) and making other efficiency improvements wherever reasonably possible. This could include using more energy-efficient hardware for data centres (Neudorfer, 2009; Ostler, 2022), building on the efficiency and measurement standards established in the EU's 2019 Regulation on Ecodesign for Servers and Data Storage Products. It should also include following developing best practices to reduce energy consumption in software development and machine learning (Patterson et al., 2021; Kaack et al., 2022; Solaiman et al., 2023). In many cases, VLOPs/VLOSEs provide tools, such as AI models, on which many other software services are built (Cobbe et al., 2023). Relatively minor changes to such models can make large differences to downstream energy consumption (Bommasani et al., 2021).

Hacker (2023) advocates for "sustainability by design" obligations, whereby companies would have to explicitly assess the environmental costs of different products, business strategies, or technologies – and preferentially pursue more sustainable options. Current AI Act proposals establish climate reporting and assessment standards, but only for high-risk and foundation models, and how these will be finalised remains to be seen. Meanwhile, Articles 34-35 of the DSA already provide a legal basis to impose such obligations. Regulators can already issue guidance clarifying that risk assessments and mitigation should include sustainability by design.

Avoiding disproportionately harmful technologies

Efficiency improvements do not automatically decrease environmental impacts, but may reduce costs and therefore increase demand and overall energy and resource use (the "rebound effect" or "Jevons paradox": see Freitag et al., 2021). Importantly, then, Articles 34-35 offer a basis not only to regulate design choices and efficiency, but also to discourage or block the deployment of products whose environmental costs far outweigh their social benefits.

The increasingly mainstream idea of a "carbon budget" communicates that there are hard limits on how much more CO_2 human societies can emit without triggering catastrophic climate change. It is therefore necessary to strictly prioritise the purposes for which carbon emissions (and other finite resources) are used – ideally prioritising economic development in poorer countries and a decent standard of living for everyone over luxury goods and services (Tooze, 2023; Fanning and Hickel, 2023). As Hacker (2023, p13) argues, whether any given technological application is worth building and deploying "is a debate…our societies must increasingly be prepared to have".

Some applications of the most energy-intensive digital technologies may have positive sustainability impacts (like reducing the need for physical travel) or other social benefits (like healthcare applications) that justify these high energy costs. However, such benefits are highly context-dependent, and are generally less relevant for many applications in fields currently leading the commercialisation of 3D video and generative AI, like video gaming (Parrish, 2023) and advertising (WPP, 2023). Currently, highly energy-intensive data-processing and machine learning tools are rapidly developing and being deployed commercially not only in emerging fields like generative AI and immersive 3D video, but also in more established areas like targeted advertising (Armitage et al., 2023, pp.89-95) and content recommendations (Reuters, 2022).

It is difficult to regard such applications as a better use of the remaining carbon budget and other acutely scarce resources than AI applications in other fields like healthcare – or, taking a more global perspective, than providing basic necessities for the 13% of people who lack access to electricity (Ritchie et al., 2022). Indeed, these technologies arguably don't even serve wealthy consumers. For example, many analysts understand major companies' rush to develop and commercialise virtual reality and generative AI more as "arms races" to control the infrastructure for future lucrative platform ecosystems than as responses to consumer demand (Chow and Perrigo, 2023; Kantrowitz, 2023).

Identifying and quantifying the environmental (and other) benefits and costs of particular technologies or applications poses formidable challenges, since they are deployed in complex systems where many actual or potential effects are indirect and unpredictable (Roussilhe, 2022). However, given the urgency of the climate crisis, the impossibility of perfectly accurate and precise predictions should not paralyse regulatory intervention. It calls for further research and broader social debate about the benefits and costs of particular products and services – not for design and deployment decisions to be left entirely up to the business interests and expansion strategies of a small number of dominant companies.

The DSA could provide the necessary basis for this kind of broader debate by requiring VLOPs/VLOSEs to assess and report on the environmental implications of product design and deployment choices, enabling civil society to independently scrutinise their decisions (Kazansky et al., 2022). This could be further facilitated by Article 40(4) of the DSA, which creates a new procedure for researchers to request internal data from platforms for research into systemic risks (Darius et al., 2023). Recital 90 of theDSA also mandates platforms to consult with civil society and relevant experts in their risk assessment procedures.

Perhaps more importantly, the DSA also provides a basis for regulatory intervention. Article 34(1) requires VLOPs/VLOSEs to conduct specific risk assessments before deploying any new functionality that significantly impacts a relevant systemic risk. Regulators can issue guidance stating that if a risk assessment finds substantial environmental impacts that are not justified by an evidence-based social benefit, deploying such a product will be regarded as a violation of the Article 35 duty to reasonably and proportionately mitigate risks.

4.2 Mitigating indirect impacts

Beyond the direct impacts of technologies, they build and use themselves, many VLOPs/VLOSEs exercise significant power over broader tech ecosystems and supply chains. Platforms that give third-party businesses access to consumers – like e-commerce marketplaces and app stores – take a very active role in regulating these smaller partners' business practices, in areas ranging from privacy and cybersecurity to fraud prevention and consumer protection (Winn, 2016; Van Hoboken and Ó Fathaigh, 2021). Indeed, this is already widely expected by consumers and regulators, and is required by many other elements of the DSA – for example its provisions on consumer protection (Cauffman and Goanta, 2021) and content moderation (Botero Arcila and Griffin, 2023, pp.24-33). Thus, it would not be a stretch for "reasonable, proportionate and effective" mitigation of environmental risks to encompass VLOPs/VLOSEs' influence over broader platform ecosystems.

E-commerce and advertising

VLOPs/VLOSEs in advertising and e-commerce influence supply chains for many goods and services (Ramesohl & Gunnemann, 2021). For example, marketplace platforms like Amazon and Zalando not only deal with their own wholesale suppliers, but also host many thousands of third-party sellers, and intermediate billions of euros' worth of consumer purchases (ecommerceDB, 2023; Silva, 2023), with significant environmental implications.

To mitigate risks under Article 35, and in line with the EU's circular economy goals, e-commerce platforms could be required to promote more sustainable products in recommendation systems; penalise sellers for wasteful practices like planned obsolescence; and display information about environmental impacts to nudge consumers towards more sustainable choices (Lell, 2023). Regulators could also use the risk assessment and mitigation system to identify and discourage design and payment practices geared towards promoting impulse purchases and overconsumption (Ah Fook & McNeill, 2020). Similar measures could also be relevant for advertising platforms: they could be required to stop hosting adverts for fossil fuel companies and other particularly unsustainable products and services, or at least penalise them (e.g., in recommendation and pricing systems).

E-commerce platforms also operate logistics systems used by many third-party sellers, representing another important pressure point to promote more sustainable production and distribution practices. Dominant platforms could be required to limit or end support for practices like free returns, which not only encourage unnecessary purchases but often result in good-as-new products going to landfill (Mull, 2021; Lell, 2023). They could also be banned from destroying brand-new goods where sellers decide this is more economical than paying for continued warehouse storage (Calma, 2021).

Software development

App stores and other platforms that provide resources to third-party software developers also exercise significant influence over software design and deployment (Van Hoboken and O Fathaigh, 2021; van der Vlist and Helmond, 2021). Indeed, they market their tight control over privacy, security, and quality of third-party applications as a selling point (Apple, 2021).

Given that app stores already play this active role in regulating consumer software, they could reasonably be required by Article 35 to establish sustainability by design requirements for third-party developers, requiring them to opt for less compute- and energy-intensive technologies where possible. This could include, for example, following best practices for energy efficiency in software development (Kruijer et al., 2023); not using machine learning where simpler technologies would work (Singh, 2023); and implementing "data sufficiency" principles to minimise unnecessary data transfers (Petri and Ruhenstoth, 2023).

If the two major smartphone app stores, Google Play and Apple, implemented such policies, this could already have meaningful impacts across consumer technology markets. Moreover, Meta and Apple are currently aiming to commercialise virtual reality products as app store-like platforms for third-party developers (Roth, 2023). If such systems are indeed widely deployed and used, given the compute-intensive technologies involved, the environmental costs could be very substantial. Imposing clear sustainability by design requirements from the start could enable the EU to take advantage of potential social and environmental benefits that such technologies may offer – for example, applications that facilitate remote work and reduce unnecessary travel – while mitigating their environmental impacts.

Finally, software platforms may exercise significant influence over the production and use of consumer devices – the manufacturing of which still represents a significant share of tech sector emissions.[3] This is most obvious in the case of companies that manufacture and sell their own devices, like Apple and Meta, but other software platforms (like Google's Android operating system) are also highly relevant, since inability to update software on older devices is one factor that frequently drives replacement (Proske, 2022). The EU is already pursuing several measures to reduce electronic waste and improve recycling and repair options (for an overview see Derivry, 2023). The DSA's risk management obligations could usefully supplement these measures by encouraging risk mitigation measures from software platforms – for example, continuing to update operating systems and security software for older devices.

5 Recommendations: risk mitigation in practice

Given the breadth and flexibility of Articles 34-35, many open questions remain about how they will be implemented. The risk mitigation measures outlined above represent plausible – and desirable – interpretations of VLOPs/VLOSEs' obligations. However, given the long and broadly defined list of risks in Article 34, and the huge range of possible mitigation measures, there is no guarantee that companies and regulators will interpret them in this way.

Questions around interpretation will be partially resolved in the coming years through the development of delegated legislation, regulatory guidance, codes of conduct, best practices, and informal norms and understandings. As the Commission, national regulators, regulated companies and civil society actors are currently gearing up for DSA implementation and developing these various interpretative tools, there is a window of opportunity now to push for a focus on sustainability.

This subsection identifies three key sets of actors who will shape DSA interpretation and enforcement. It highlights the role they could each play in ensuring that risk mitigation measures include a focus on sustainability, and offers concrete recommendations for each.

5.1 Platform companies: sustainability by design

In the DSA's risk mitigation framework, VLOPs/VLOSEs are the first actors responsible for identifying risks and deciding how to mitigate them. Article 41 requires VLOPs/VLOSEs to establish compliance departments under an independent senior manager, reporting directly to top management, who will be primarily responsible for ensuring risks are appropriately assessed and mitigated. Compliance staff could and should prioritise environmental risks and mitigation measures like those outlined above, and should consult widely with civil society and academic experts on how to best address environmental impacts, as mandated by Recital 90 of the DSA. This would not only strengthen DSA compliance, but also align with existing ESG goals and regulatory requirements (Violino, 2023), and help companies prepare for their future obligations under the Corporate Sustainability Due Diligence Directive and Corporate Sustainability Reporting Directive.

In particular, companies should develop and incorporate sustainability by design – procedures to evaluate the environmental benefits and costs of different available technologies, design choices, and business strategies, and preferentially pursue the most sustainable options – into their DSA risk assessments and mitigation measures. These processes should bring together compliance departments with senior managers from across different parts of the organisation to coordinate between departments focused on regulatory compliance,

[3] In France this is as much as 79% (Arcep, 2023), though such impacts are challenging to estimate and vary significantly depending on factors including the mix of energy sources in countries where devices are manufactured and used (Clément et al., 2020).

business strategy, and technological design. Climate and sustainability considerations should also be incorporated into policies regulating third-party business users, for example requiring them to document similar sustainability by design processes.

5.2 Regulatory agencies: establish clear codes and guidance

Even where compliance officers formally have significant authority and responsibilities and are strongly motivated to achieve regulatory goals, in practice it can be difficult for them to get the necessary budget and buy-in from other parts of the organisation for significant changes (Waldman, 2020, 2021). Strong legal incentives and pressure from external actors will also be necessary. This pressure can most obviously come from regulators.

The Commission is responsible for enforcing the DSA's risk mitigation framework. It can ultimately decide whether platforms' risk assessments have adequately considered all the risk areas mentioned in Article 34, and whether identified risks have been appropriately mitigated. If not, it is empowered to require "action plans" on how VLOPs/VLOSEs will address inadequate compliance, and ultimately issue fines. Article 35(3) also empowers the Commission to issue *ex ante* guidance on regulatory interpretation.

National regulators are not directly responsible for overseeing Articles 34-35, but can also participate in shaping their interpretation. Article 35(2) empowers the European Board for Digital Services (representing national regulatory agencies) to publish reports identifying the most important systemic risks and best practices for risk mitigation.

In their guidance, both the Commission and Board should prominently highlight climate and other environmental issues as pressing systemic risks, and outline best practices for mitigating them, such as those identified in section 4. An essential component of this will be establishing standard methodologies for calculating and reporting emissions and other environmental impacts, so that VLOPs/VLOSEs' risk mitigation measures can be evaluated and compared. Relevant best practices, reporting standards, and success metrics for sustainability by design should also be included in industry codes of conduct developed under Article 45 of the DSA. Finally, the Commission should be ready to investigate potential violations of Article 35 where platforms do not successfully implement adequate sustainability policies.

5.3 Civil society and academia: understanding climate risks

The definition, understanding, and evaluation of risks is ultimately a political process, which can easily be "captured" by regulated companies defining risk in accordance with their own business interests, but can also be shaped by broader policy debates (Waldman, 2020; Kaminski, 2023; Parfitt and Bryant, 2023). Through consultation and participation processes, civil society organisations and academics can highlight the importance of sustainability and propose appropriate risk mitigation measures.

Academics, civil society, and researchers should consistently emphasise sustainability and climate issues when participating in formal DSA consultations with platforms (for example during risk assessment processes, as set out in Recital 90) and policymakers (for example, through open consultations on legislative proposals, and other proposed institutions such as expert committees: see Vergnolle, 2023). They should also consistently stress such issues in informal consultations and discussions.

Quantifying the environmental benefits and harms of specific technologies and applications is often challenging (Roussilhe, 2022). Measuring the indirect environmental impacts of VLOPs/VLOSEs' business practices across supply chains and platform ecosystems is even more complicated. More research in this area is urgently needed, not only to enable evidence-based risk mitigation measures and regulatory oversight under the DSA (Darius et al., 2023), but also to support other regulatory interventions and legal measures such as climate litigation. Article 40(4)'s right for independent researchers to access platforms' internal data will create new opportunities for research that exposes and quantifies VLOPs/VLOSEs' environmental impacts, and those of other businesses in their platform ecosystems. Conducting such research should be a priority for academic researchers, civil society, and funding institutions.

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