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Kneschke v LAION in Hamburg (LG 2024; OLG 2025): A First-Step, Extensive Commentary on Two Decisions and Germany's TDM Exceptions for AI Training

Abstract

This first-step, extensive commentary analyses the two Hamburg decisions in Kneschke v LAION—LG Hamburg (27 September 2024) and OLG Hamburg (10 December 2025)—as an early European reference point for assessing whether the compilation of large-scale AI training datasets from copyrighted works can be justified under text-and-data mining (TDM) limitations. It explains how the courts characterised the automated downloading and image–text matching used to build the LAION dataset as "text and data mining", and how this characterisation interacts with the German implementations of Articles 3 and 4 DSM Directive (§ 60d and § 44b UrhG). Particular attention is paid to the appellate court's reframing of the dispute around § 44b UrhG and the practical operability of opt-outs, insisting that any reservation of rights must be expressed in machine-readable form under § 44b(3) sentence 2 UrhG, while also confirming that § 60d UrhG would justify the mining on the facts despite potential downstream commercial use absent a determining influence of a private undertaking. The article closes by identifying the remaining doctrinal pressure points—especially the boundary between lawful mining and downstream dissemination/making available, and the standards for effective, enforceable reservations of rights—against the background of emerging transparency obligations in the EU AI Act.

Keywords: artificial intelligence; generative AI; AI training datasets; copyright; text and data mining; Kneschke; LAION; LG Hamburg; OLG Hamburg; § 44b UrhG; § 60d UrhG; DSM Directive; machine-readable opt-out; EU AI Act; Germany

Dimitrios Devetzis[1] **and Ioannis Giokaris**[2]

[1] Dimitrios Devetzis (Dr. iur., LL.M., M.L.E.), Assistant Professor of Law, Department of Law, Frederick University Cyprus; EU Legal Expert in Private Law – Law & Technology; e-mail: law.dd@frederick.ac.cy

[2] Ioannis Giokaris (Dr.), Lecturer, Department of Law, Frederick University Cyprus; e-mail: law.ig@frederick.ac.cy

1. Introduction

In late 2024, the Regional Court of Hamburg (*Landgericht Hamburg*) delivered a groundbreaking decision concerning the use of copyrighted works in AI training datasets.[3] The case—*Kneschke v LAION e.V.*—is notable as the first European judgment to directly address whether compiling a large dataset of images (the 'LAION 5B' dataset) for training generative AI models infringes copyright, or whether it can be excused under legal exceptions.[4][5] At its core, the dispute raised the tension between the rights of creators over their works and the societal interest in facilitating technological innovation through machine learning.

The plaintiff, a professional photographer, alleged that LAION (a German non-profit organisation creating open AI datasets) unlawfully copied his photograph into an AI training database without permission, violating his exclusive rights.[6] LAION defended its actions as legal text-and-data mining in the name of scientific research, pointing to a new copyright exception in German law (transposing recent EU directives) that permits such uses under certain conditions.[7] The Hamburg court ultimately dismissed the photographer's claim, accepting that LAION's creation of the dataset fell within the scope of this exception.

This decision has sparked extensive debate in legal circles, not least because it touches on novel issues at the intersection of copyright law and artificial intelligence. The ruling interprets Germany's implementation of EU 'text and data mining' (TDM) exceptions—provisions only introduced in 2021—and applies them to the context of generative AI training. It therefore provides an early judicial view on how broadly these exceptions may shield AI developers (even non-commercial ones) when they scrape and process protected works.[8] Moreover, the court's reasoning (and notable omissions) have prompted commentary on whether it struck the right balance between fostering innovation and safeguarding creators' interests.[9]

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[3]Landgericht Hamburg, Urteil vom 27. September 2024 – 310 O 227/23 (Kneschke v LAION e.V.). This appears to be the first European court judgment addressing the scope of copyright exceptions in the context of AI training datasets.

[4]Thomas Hoeren, 'Drei Mythen und ein Todesfall: Urheberrechtliche Fragen bei der Generierung von KI-Daten' (Beck-Online Gastkommentar, 28 November 2024) <https://rsw.beck.de/aktuell/daily/meldung/detail/gastkommentar-hoeren-urheberrechtliche-fragen-generierung-ki-daten-scraping> accessed 2 January 2025. Prof. Hoeren describes this as 'wahrscheinlich das europaweit erste Urteil' on AI training and copyright.

[5]Eleonora Rosati, 'The German LAION Decision: A Problematic Understanding of the Scope of the TDM Copyright Exceptions and the Transition from TDM to AI Training' (The IPKat, 7 October 2024) <https://ipkitten.blogspot.com/2024/10/the-german-laion-decision-problematic.html> accessed 2 January 2025.

[6]Robert Kneschke, 'Meine Klage gegen LAION e.V. wurde in erster Instanz abgewiesen' (Alltag eines Fotoproduzenten, 21 October 2024) <https://www.alltageinesfotoproduzenten.de/2024/10/21/meine-klage-gegen-laion-e-v-wurde-in-erster-instanz-abgewiesen/> accessed 2 January 2025. The plaintiff provides his personal account of the proceedings and his critique of the court's reasoning.

[7]Bird & Bird, 'Long-awaited German judgment by the District Court of Hamburg (Kneschke v. LAION) on the text and data mining exception(s)' (twobirds.com, October 2024) <https://www.twobirds.com/en/insights/2024/germany/long-awaited-german-judgment-by-the-district-court-of-hamburg-kneschke-v-laion> accessed 2 January 2025.

[8]See eg Vossius & Partner, 'Hamburg Regional Court Rules on Training Data for Artificial Intelligence – LAION case' (16 October 2024) <https://www.vossius.eu/en/news/detail/hamburg-regional-court-rules-on-training-data-for-artificial-intelligence>; Dirks S, 'KI-Urteil: Landgericht Hamburg weist Klage gegen "LAION 5B" ab' (17 October 2024) <https://www.dirks.legal/2024/10/17/ki-urteil-landgericht-hamburg-weist-klage-gegen-laion-5b-ab/>.

[9]Rosati (n 3). Dr Rosati criticises the decision for failing to consider whether LAION's subsequent act of making the dataset publicly available constituted a separate restricted act not covered by the TDM exceptions.

This analysis will examine the legal framework underpinning the decision, including German and EU copyright law, and critically evaluate the court's application of the TDM exceptions. It will also consider the wider implications of the *LAION* ruling—both legal and ethical—for the ongoing debate about AI training datasets. Questions of compliance with European law, the potential need for appellate clarification, and the concerns of authors and artists whose works feed these AI systems will be explored. By drawing on legislation, case law, and academic commentary from both English and German sources, this essay aims to provide a comprehensive understanding of the *LAION* ruling's significance under German and EU law and its broader social context.

2. Background: LAION, AI Datasets, and Copyright

Modern generative AI systems (such as image generators and large language models) rely on training data of unprecedented scale. LAION (Large-scale Artificial Intelligence Open Network) is a non-profit initiative that assembled one of the largest open datasets for AI training: a collection of approximately 5.85 billion image-text pairs gathered from the internet.[10] These images, found online (for example, on photo websites and platforms), are paired with textual descriptions or metadata, and the resulting dataset is made publicly available for AI research and development purposes.

The plaintiff Robert Kneschke is a professional photographer who discovered that one of his photographs, which he had uploaded as a preview (watermarked) on a stock image site, was included as an entry in LAION's dataset.[11] The stock agency's terms of use explicitly prohibited automated scraping of its content. Kneschke sued LAION e.V. in Germany, claiming that the inclusion of his image in the dataset (even if only as a URL and associated data, or as a temporarily downloaded file for analysis) amounted to an unauthorised reproduction and use of his copyrighted work.[12] He argued that no statutory limitation or defence in copyright law justified this use, since, in his view, none of the copyright exceptions for text or data mining were meant to allow wholesale copying of creative works into AI training corpora. The case thus squarely presented the issue: is compiling an AI training dataset from online images a form of copyright infringement, or can it be lawful under copyright exceptions in Germany and the EU?

To address this question, it is important to outline the legal framework governing copyright and exceptions for data mining. Under both German law and EU law, the default rule is that acts of reproducing copyrighted material (such as downloading or storing a photo) require the author's authorisation, unless an exception or limitation applies. The German Copyright Act (*Urheberrechtsgesetz*, UrhG) grants authors the exclusive right to reproduction (§ 16 UrhG) and to making the work available to the public (§ 19a UrhG) among other rights. These cover copying works into memory or onto storage and making them accessible on the internet.

There was little doubt that LAION's actions—using a bot to fetch the image from the web and process it, thereby creating at least a transient copy, and incorporating information about it into a dataset distributed to others—implicated the photographer's reproduction right. Even if LAION did not permanently store the full image file in the released dataset (LAION's dataset contains hyperlinks to images and some metadata, rather

[10]LAION (Large-scale Artificial Intelligence Open Network) e.V. is a German non-profit organisation that assembled the LAION-5B dataset containing approximately 5.85 billion image-text pairs. See <https://laion.ai/>.

[11]Kneschke (n 4). The plaintiff's photograph was uploaded as a watermarked preview on the stock image platform bigstock.com, whose terms of service expressly prohibited automated scraping.

[12]Landgericht Hamburg, Urteil vom 27 September 2024 – 310 O 227/23; Kneschke R, 'Meine Klage gegen LAION e.V. wurde in erster Instanz abgewiesen' (21 October 2024) <https://www.alltageinesfotoproduzenten.de/2024/10/21/meine-klage-gegen-laion-e-v-wurde-in-erster-instanz-abgewiesen/>.

than the images themselves),[13] the act of crawling and downloading the image for analysis is itself a reproduction under the broad definition in EU law.[14] The key issue, therefore, was whether LAION could invoke a copyright exception that permits copying for purposes of data analysis or research without the rightsholder's consent.

3. Legal Framework: Copyright Exceptions for Text and Data Mining

3.1 EU Directives and German Implementation

Historically, copyright laws lacked explicit provisions for **text and data mining (TDM)**—the automated analysis of large volumes of data (including copyrighted works) to discover information or train algorithms. The legal uncertainty around mining data from protected works (e.g., scraping texts or images for analysis) led the European Union to introduce specific exceptions in the Directive (EU) 2019/790 on Copyright in the Digital Single Market ('DSM Directive').[15] Articles 3 and 4 of this Directive, for the first time in EU law, permit certain TDM activities that would otherwise infringe copyright, subject to conditions.

Article 3 DSM Directive requires Member States to allow reproductions and extractions of works for the purposes of text and data mining **for scientific research**, provided the mining is carried out by research organisations or cultural heritage institutions (e.g., universities, research institutes, libraries, etc.) in pursuit of a non-commercial research objective.[16] Rightsholders cannot opt out of this exception (it is mandatory), and any contractual terms to the contrary have no effect.[17] Article 4 DSM Directive provides a separate TDM exception for other users (e.g., companies or individuals mining content for commercial purposes or generally)—but that exception allows rightsholders to reserve their rights (for instance, by expressing that their website or content may not be mined).[18]

In other words, under Article 4, if a rightsholder clearly signals (in a machine-readable way, or in the case of implementation under German law, via '**Opt-Out**' notices) that data mining is not permitted, then the exception does not apply and mining would be infringing. Both exceptions are limited to acts of reproduction or extraction necessary for the data analysis; they do not themselves permit subsequent acts like sharing the data or using the content in other ways.[19] EU law also maintains the general *three-step test* (from Article 5(5) of the InfoSoc Directive 2001/29/EC and international copyright treaties) to ensure any exception is confined to certain special cases that do not conflict with a normal exploitation of the work or unreasonably prejudice the rightsholder.[20]

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[13]On the structure of the LAION-5B dataset as URL-based image–text pairs (rather than a repository of the full image files), see LAION e.V., 'LAION-5B' <https://laion.ai/blog/laion-5b/>; cf Landgericht Hamburg (n 1) (facts).

[14]Tim W Dornis, 'The Training of Generative AI Is Not Text and Data Mining' (2025) 47(2) European Intellectual Property Review 89 (forthcoming). Available at SSRN: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4993782>.

[15]Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC [2019] OJ L130/92 (DSM Directive), arts 3–4, 7.

[16]ibid art 3(1). The exception applies to research organisations and cultural heritage institutions acting for non-commercial scientific research purposes.

[17]ibid art 7(1), which provides that any contractual provision contrary to the exceptions in arts 3, 5(1) and 6 shall be unenforceable.

[18]ibid art 4. Unlike art 3, this general TDM exception permits rightsholders to reserve their rights through 'appropriate means', including machine-readable formats.

[19]DSM Directive arts 3(1) and 4(1) (permitted acts limited to reproductions/extractions necessary for TDM); cf Directive 2001/29/EC (InfoSoc) art 5(5) and Berne Convention art 9(2) (three-step test).

[20]Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society [2001] OJ L167/10 (InfoSoc Directive), art 5(5).

Prior to moving on to the German implementation of the DSM Directive, it is worth noting the background and the underpinning that guided the introduction of the Article 3 exception. Two key concepts are at the core of this exception: (i) promoting innovation, while (ii) safeguarding rightsholders' rights through a thoughtful balancing exercise. With respect to the first, Recital 5 of the DSM Directive contends the need to reassess existing exceptions and limitations, relevant *inter alia* for scientific research and innovation, particularly in view of new use cases that have emerged in recent years.[21] Arguably, these use cases include the advent of AI technology and the plethora of its capabilities.

The DSM Directive, hence, calls for the need to introduce mandatory exceptions for uses of text and data mining technologies, in addition to the already existing exceptions and limitations. By doing so, the DSM Directive acknowledges the need to advance innovation through the introduction of exceptions. In fact, complex regulations have often been criticised for introducing a web of rules that materially impact the ability of research organisations and researchers to innovate. The DSM Directive addresses this criticism by being proactive, in an effort to facilitate scientific research.

With respect to the second concept, Recital 4 of the DSM Directive posits that the exceptions and limitations are not considered lightly, but rather seek to achieve a fair balance between 'the rights and interests of authors and other rightholders, on the one hand, and of users on the other'. Fair balancing is at the core of EU legislation, as in most legal systems globally, since it recognises that for every exception there is a flipside, and legislators need to be mindful of the interplay between various rights before proceeding with a new provision.

In this case, there is a preliminary conflict between the rightsholders, who should be able to protect their intellectual property and be compensated for any use, and the exception to said right, particularly since the exception is mandatory and cannot be diluted or circumvented through a national implementing law. The conflict is resolved through the balancing exercise, particularly since scientific research conducted by research organisations may have a broader positive externality and lead to scientific breakthroughs that will benefit the entire society. It is the very fabric of research, and its capabilities, that justify the exception in this case. However, this underscores the importance of clearly delineating the scope of the exception, as well as what falls into the category of 'research organisations', as further discussed below.

Another interesting point of investigation in the DSM Directive is the notion of *research organisations*. According to the DSM Directive, this encapsulates a plethora of different bodies (Recital 12), whose primary goal is to conduct scientific research.[22] The term 'scientific research' covers both natural sciences and human sciences. With respect to the scope of these organisations, they are not restricted to universities and other higher education institutions, but also cover research institutes and hospitals. The legal form of the entity as such is not relevant; rather, the actual aim and undertakings of the entity are crucial—in particular, the fact that they act either as a non-profit or in the public interest.

Factors that can contribute to the determination of such mission include public funding, public contracts, or similar provisions. An important distinction is introduced here, namely organisations where commercial undertakings have decisive influence that allows the undertaking to exercise control. This means that a research organisation with a shareholder structure where a commercial entity would exercise material influence would likely not be able to enjoy the exception of Article 3.

Finally, Article 3 of the DSM Directive refers to 'lawful access' to works. In exploring what this means, it pertains to content that is acquired through a subscription,

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[21]DSM Directive (n 13), recitals 4, 5, 12, 14, 17, 18.

[22]DSM Directive (n 13), recital 12, which defines research organisations as entities whose primary goal is to conduct scientific research or educational activities involving such research.

licence, or other contractual arrangements (e.g., a university subscription to a dataset), or if there is free access or open access to the material (Recital 14). All these key elements are imperative because they form the basis for the exception, under the assumption that the rightsholders will suffer minimal, if any, harm by this use. This is why EU Member States do not provide compensation to the rightsholders regarding text and data mining (Recital 17).[23]

Germany implemented these new EU provisions through amendments to the UrhG in June 2021. Two key sections were added: § 44b UrhG (general text and data mining) and § 60d UrhG (text and data mining for purposes of scientific research).[24] Section 44b UrhG corresponds to Article 4 DSM Directive—it allows anyone to make reproductions of lawfully accessible material for text and data mining, for any purpose (including commercial), **but only so long as the rightsholder has not reserved their rights** (by declaring an objection to such use).[25]

The reservation of rights typically must be done in a machine-readable standard (such as a meta-tag or robots.txt that forbids text/data mining) to be effective, reflecting Article 4(3) DSM Directive's requirement of a clear opt-out. By contrast, § 60d UrhG implements the narrower, research-focused exception of Article 3 DSM. This provision is central to the *LAION* case. Section 60d(1) UrhG permits reproductions of works for the purpose of text or data mining in the context of **scientific research**, and it cannot be contracted away.

However, it strictly limits who can benefit: § 60d(2) and (3) UrhG define eligible users to include '*Forschungsorganisationen*' (research organisations)—essentially universities, research institutes, or other entities whose primary goal is scientific research—provided they operate on a not-for-profit basis or in the public interest.[26] Publicly accessible libraries, museums, and archives can also rely on it, as can individual researchers doing non-commercial work. The law explicitly excludes research organisations that are *de facto* controlled by commercial companies or that grant companies preferential access to results,[27] to prevent abuse by corporate actors hiding behind a research partner.

In sum, § 60d UrhG grants a tightly scoped privilege: non-profits engaged in genuine research can copy works as needed for data analysis (without permission), **even if the rightsholder objects**, so long as the use is non-commercial and for scientific purposes. Any copies made under § 60d must generally be deleted once the research is completed, or kept secure, and they can only be shared with a defined circle of collaborators (not openly published).[28]

Beyond these TDM-specific exceptions, general copyright law has other doctrines that could be relevant to AI training. For example, § 44a UrhG (transposing Article 5(1) InfoSoc Directive) allows temporary acts of reproduction that are transient or incidental

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[23]DSM Directive art 3(1) (requirement of lawful access) and recitals 14 and 17 (including access via subscription/licence and the relevance of contractual arrangements).

[24]Urheberrechtsgesetz (German Copyright Act) § 60d, as amended by Gesetz zur Anpassung des Urheberrechts an die Erfordernisse des digitalen Binnenmarktes vom 31. Mai 2021 (BGBl. I S. 1534). For the full text, see <https://www.buzer.de/60d_UrhG.htm>.

[25]ibid § 44b, implementing DSM Directive art 4. This general TDM exception allows mining of lawfully accessible works unless the rightsholder has expressly reserved their rights.

[26]ibid § 60d(2)–(3). Research organisations (Forschungsorganisationen) include universities, research institutes, and other entities primarily engaged in scientific research, provided they operate on a non-profit basis or in the public interest.

[27]ibid § 60d(2) sentence 3, which excludes organisations under the decisive influence of commercial undertakings or those granting preferential access to research results.

[28]ibid § 60d(4), which limits the public accessibility of reproductions to specific collaborators for joint research or quality verification purposes.

and an essential part of a technical process (the classic 'cache' exception).[29] However, in the *LAION* case, the court found § 44a inapplicable—the creation of a permanent dataset of billions of entries went beyond a mere transient cache copy. Another concept in some jurisdictions is fair use (as in the US) or broader flexible exceptions, but German law does not have a general fair use clause; it relies on specific enumerated exceptions like those above. Thus, the outcome hinged on whether LAION's activities fit within § 60d (or potentially § 44b) UrhG.

3.2 Copyright, AI Training, and the 'Purpose of Scientific Research'

A pivotal legal question was whether LAION's building of the dataset qualified as an act 'for purposes of scientific research' under § 60d. While LAION e.V. is a non-profit entity, it is not a university or traditional research institute; it is an association aiming to advance AI research by creating open datasets. The statute (§ 60d(2) UrhG) does include 'other institutions that conduct scientific research' in its definition of research organisations, as long as they meet the non-commercial or public interest criteria.[30] LAION argued that it fits this definition—its mission is to enable and support research, and it does not itself operate for profit.[31]

The photographer-plaintiff was sceptical that LAION's work (essentially web-scraping images and publishing a dataset) could be deemed 'scientific research' in the true sense, noting that LAION collaborated with or at least enabled commercial tech companies who downloaded the dataset for their own AI training.[32] This raised the issue of whether the involvement of commercial actors downstream would disqualify the use of § 60d by LAION. Formally, the court only needed to consider LAION's purpose and status, not the uses by third parties: if LAION's act of making the copy was for non-commercial research, the exception might still apply even if others later use the result for profit.

The law's text requires the *organisation itself* to be non-commercial and not under controlling influence of a company,[33] and LAION as an independent non-profit likely cleared that hurdle in the court's view.[34]

Another aspect of 'scientific purpose' was whether compiling a raw dataset can count as a research activity, even if it does not immediately yield scientific insights. The plaintiff contended that merely creating a database of images is not 'research'—it is a preparatory act that in itself does not generate new knowledge.[35] However, the Hamburg court firmly rejected this narrow view. It reasoned that constructing a training dataset is an integral part of the scientific process in machine learning research. Before researchers can experiment with AI models, they need to assemble and preprocess data; this *data mining phase* is the foundation for later research results.[36]

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[29]ibid § 44a, transposing InfoSoc Directive art 5(1). The Hamburg court found this temporary reproduction exception inapplicable to the creation of permanent datasets.

[30]Urheberrechtsgesetz (UrhG) § 60d(2) (definition of 'Forschungsorganisation'), read with DSM Directive art 2(1) and recital 12.

[31]Bird & Bird (n 4). The court held that LAION qualified as a research organisation under § 60d(2) UrhG because its primary mission was to enable and support scientific research in AI.

[32]Kneschke R, 'Meine Klage gegen LAION e.V. wurde in erster Instanz abgewiesen' (n 4); Kneschke R, 'Aktueller Stand meiner Klage gegen LAION e.V.' (22 December 2025) <https://www.alltageinesfotoproduzenten.de/2025/12/22/aktueller-stand-meiner-klage-gegen-laion-e-v/>.

[33]UrhG § 60d(2) sentence 3 (exclusion where the research organisation is under the controlling influence of a private undertaking or grants preferential access to research results).

[34]Landgericht Hamburg (n 1) (finding that LAION e.V. operates as an independent non-profit and was not shown to be under the determining influence of a private undertaking).

[35]Kneschke (n 4) (criticising the characterisation of dataset compilation as 'scientific research').

[36]Hoeren (n 2). Prof. Hoeren notes that the decision affirms that dataset creation is an integral part of the scientific research process in machine learning, not merely a preparatory act.

Thus, the court held that reproductions made to build the LAION 5B dataset were indeed done for scientific research purposes, since the end goal was to facilitate research in AI and inform the development of new AI models. This functional interpretation aligns with the broad objectives of the TDM exception, acknowledging that in data-driven science, creating datasets and analysing them is part of research itself. German commentators have noted that this reading of § 60d is sensible, as it ensures the exception covers all steps of a research project's lifecycle—from data gathering to analysis—rather than arbitrarily excluding the initial compilation stage.[37]

Professor Thomas Hoeren, commenting on the case, praised the court's clarification that data mining for scientific purposes includes preparatory acts like dataset creation, calling it a deservedly positive interpretation of § 60d.[38] It suggests that the judiciary will not impose an unduly strict threshold whereby only immediate analytical acts are protected—a relief for research organisations that spend significant effort in data collection.

4. The LAION Judgment in Hamburg

4.1 Court Decision and Reasoning

In its judgment of 27 September 2024 (Case 310 O 227/23), the Hamburg court ruled in favour of LAION e.V., finding that the **text and data mining for research exception (§ 60d UrhG)** shielded LAION's acts of copying in this instance.[39] The court dismissed the photographer's claim of copyright infringement, holding that LAION's downloading and processing of the image was a permitted act of reproduction for scientific research purposes. The crucial determination was that LAION qualified as a research organisation pursuing non-commercial aims, and that its data-scraping activity was in service of scientific machine learning research.[40]

The fact that LAION made the dataset freely accessible did not negate the characterisation of its purpose as scientific—at least with respect to the initial reproduction of the works. In the court's view, LAION itself was not engaged in any commercial exploitation of the photos; it was facilitating open research.

From the information provided by the parties and the court's reasoning, several key points emerge. First, the court noted that the plaintiff's image was **lawfully accessible** on the internet—it was available as a preview on a stock site (albeit watermarked) to any user.[41] This meant LAION did not circumvent any technical protection to get the image; it was essentially publicly on display (which is relevant because both § 44b and § 60d only allow mining of lawfully accessible material, not hacked or pirated copies).

The plaintiff's argument that the website's terms of service prohibited scraping was acknowledged, but critically, the court found that this human-readable prohibition **did not amount to an effective reservation of rights under the law**.[42] In an *obiter dictum*, the court mused that modern AI techniques might even be used to interpret natural-language terms and possibly treat them as machine-readable, but ultimately it did not base its decision on this point. Instead, since the court decided the § 60d research exception

[37]Landgericht Hamburg (n 1); see also Hoeren (n 2) (supporting a functional reading of § 60d that covers preparatory dataset compilation).
[38]Hoeren (n 2).
[39]Landgericht Hamburg (n 1).
[40]Landgericht Hamburg (n 1); see also Vossius & Partner (n 6).
[41]Landgericht Hamburg (n 1) (lawful online accessibility of the claimant’s preview image).
[42]Kneschke (n 4). The court acknowledged that the stock site's terms prohibited scraping but found this human-readable notice did not constitute an effective reservation of rights under the statutory framework.

applied, the issue of an opt-out under § 44b (which would have barred the general TDM exception) was sidestepped as not decisive.[43]

However, the judgment spends considerable space discussing '*Maschinenlesbarkeit*' (machine readability) of opt-outs, indicating the judges were aware that if LAION had to rely on the general mining right (§ 44b), the stock site's no-scraping clause could be relevant. The court hinted that LAION, as a sophisticated entity, perhaps should have recognised and honoured the no-scraping term if § 44b were in play, and that such natural language could potentially be made machine-interpretable.[44] Nonetheless, under § 60d, rightsholders have no right to opt out at all—even a clear objection would not prevent the use.

Thus, by classifying LAION's use under § 60d, the court effectively mooted the plaintiff's reliance on the site's terms of service. Contractual terms cannot override a statutory exception in this domain, especially one intended to be unwaivable for research purposes.[45]

Secondly, the court addressed the contention that LAION's activities were indirectly commercial because private companies could utilise the dataset. In a passage from the judgment, the court acknowledged that the dataset was used by commercial entities to train or improve AI systems.[46] However, it found that this did not retroactively make LAION's act a commercial one. LAION itself did not profit from the dataset; it provided it openly. The exception in § 60d requires the reproductions to be made for a non-commercial scientific project by a qualified organisation, and those conditions were met.

The law does not explicitly require that the data or results be kept out of commercial hands entirely (though § 60d(4) limits public sharing of copies to certain contexts).[47] The court seems to have been satisfied that LAION's motives were scientific and educational, not to run a business exploiting the images. German legal scholars have observed that the decision thus sets a relatively low bar for what counts as non-commercial research use.[48] The plaintiff criticised this, arguing that LAION's 'research activity' was not proven with rigour and that the ruling makes it too easy for organisations to claim the mantle of science. Indeed, if any non-profit that publishes datasets can qualify, one might see an influx of entities trying to fit that definition to escape liability.

Thirdly, as mentioned, the court **did not explicitly rule on § 44b UrhG (the general TDM exception)**, since it found for LAION under § 60d. However, it made some telling observations. Notably, it remarked on the requirement of **machine-readable opt-outs**. The plaintiff had effectively 'reserved rights' by the site's notice against scraping, but this was not in a format meant for web crawlers (like a robots.txt or meta tag). The German implementation, mirroring Article 4(3) DSM Directive, implies that rights can be reserved through 'appropriate measures' (which in context suggests machine-readable signals).[49]

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[43]Landgericht Hamburg (n 1); see also Vossius & Partner (n 6) (noting that the court did not need to decide § 44b because § 60d applied).

[44]Landgericht Hamburg (n 1) (discussion of ‘Maschinenlesbarkeit’ and natural-language restrictions); Hoeren (n 2).

[45]DSM Directive art 7(1) (contractual override); UrhG § 60g(1) (contractual provisions contrary to §§ 60a–60f are unenforceable).

[46]Landgericht Hamburg (n 1) (acknowledging downstream commercial use of LAION-5B); see also Vossius & Partner (n 6).

[47]UrhG § 60d(4) (limits on making reproductions accessible beyond a defined circle for joint research/verification).

[48]See eg Dirks (n 6); Rosati (n 3) (questioning the practical threshold for ‘non-commercial’ research in the LAION setting).

[49]UrhG § 44b(3) (opt-out; machine-readable requirement for online works) implementing DSM Directive art 4(3).

The judgment suggests that a plain-language prohibition *might not* satisfy the condition to exclude the exception—or at least it raised doubts about it.[50] In effect, the court leans toward a strict view that rightsholders must use the technically envisaged means to opt out of general TDM; otherwise, miners might not be bound to observe the objection. This issue did not have to be resolved definitively in *LAION*, but it sends a message: content owners who want to prevent mining should implement explicit machine-readable exclusions on their websites or content feeds.

For AI developers, the case highlights that relying on the general TDM exception (§ 44b) is riskier if they ignore stated restrictions, whereas the research exception (§ 60d) is more robust (as it disallows *any* opt-out by rightsholders).[51]

Finally, it is worth noting what the court *did not* address. According to observers, the court failed to consider that LAION's subsequent act of **making the dataset available to the public** might itself implicate copyright, beyond the initial reproduction.[52] LAION not only made copies for its own analysis; it published the list of image links and data for anyone to download. While LAION did not distribute the photos themselves, providing the dataset could be seen as an act of making available a substantial part of a database of works (raising questions under the EU Database Directive or even as an act of facilitation of infringement if users then fetch all images).[53]

The Hamburg court did not engage with whether releasing the dataset to all (including commercial users) was permitted under § 60d. In fact, § 60d(4) UrhG would appear to limit sharing to a defined circle for collaborative research or verification purposes,[54] not open publication. Dr Eleonora Rosati has pointed out that the decision is incomplete on this front: after LAION's TDM activity (which might be lawful), the open publication of the dataset likely fell outside any exception, meaning it could constitute an infringing act if it involved reproducing or communicating protected content.[55]

The court perhaps treated the dataset as merely a 'table of hyperlinks' not containing the protected images themselves, thereby sidestepping the issue of a further use of the works. But this leaves a grey area—whether such dissemination of mining results is allowed. Critics argue that future courts or a higher court on appeal should address this to prevent a loophole where one could cloak mass copying in research but then effectively supply it for commercial exploitation by others.[56] In summary, the judgment strongly favours a pro-TDM interpretation of the law but may have overlooked the full chain of uses in LAION's case.

4.2 Academic and Legal Commentary on the Ruling

The *LAION* ruling has been met with mixed reactions in the legal community, with commentary in both German and English analyses highlighting its broader implications. Many commentators acknowledge the decision as a landmark precedent—'*wahrscheinlich das europaweit erste Urteil*' on the scope of copyright in AI training, as Prof. Hoeren

[50]Landgericht Hamburg (n 1) (obiter on plain-language restrictions); cf OLG Hamburg (n 76) 11, 18 (machine-readable opt-out requirement).
[51]See eg Bird & Bird (n 5); Vossius & Partner (n 6).
[52]Rosati (n 3) (arguing that the judgment did not engage with the separate question of making the dataset available after the mining stage).
[53]Rosati (n 3) (discussing potential database-law and 'making available' issues arising from the public release of LAION-5B).
[54]UrhG § 60d(4); cf UrhG § 60d(3) (storage and security obligations).
[55]Rosati (n 3).
[56]See eg Rosati (n 3); Böhme R and Pesch PJ, 'Artpocalypse now? – Generative KI und die Vervielfältigung von Trainingsbildern' (2023) 125(14) GRUR 997.

notes.[57] It is seen as an important test of the new TDM exceptions under real-world conditions.

The praise for the court's affirmation of the § 60d exception's applicability is often coupled with concerns about how far the reasoning stretches. For instance, some German scholars welcome the message that Germany is friendly to AI research: by clearly allowing non-commercial data scraping for scientific purposes, the court has given research organisations and open-data initiatives a green light to continue their work without fear of crippling liability.[58] The decision underscores that copyright law, even after recent reforms, can accommodate cutting-edge technological development—dispelling the notion that AI necessarily 'brutally threatens' creators' rights, as the content industry has sometimes claimed.[59]

In fact, in the wake of this case, rightsholders' groups like collecting societies had started positioning themselves to demand licences or remuneration for AI training uses, and this judgment pours some cold water on those efforts (at least regarding pure research contexts).

On the other hand, critical voices argue that the court adopted a **problematic understanding** of the TDM exceptions' scope. Dr Rosati's analysis contends that the decision provides incomplete guidance, since it failed to consider the downstream use of the dataset and treated the matter as if only reproduction (and not subsequent sharing) was in question.[60] If other courts followed Hamburg's reasoning to the letter, they might ignore the fact that AI training often involves multiple steps—initial data mining (potentially covered by exceptions) and then deployment or sharing of models or data (which may not be covered).

Thus, stakeholders relying on this ruling might be misled; what LAION did in releasing the dataset freely might still be infringing, a nuance the court omitted. Additionally, there is debate about whether LAION truly fits the definition of a research organisation under EU law. Recital 12 of the DSM Directive and the text of § 60d imply that *organisations* whose primary goal is research and that reinvest all profits into it can qualify.[61] LAION e.V. likely meets this, but some worry this opens a floodgate for quasi-research entities to scrape data and claim shelter under § 60d while effectively aiding commercial AI development indirectly.[62]

The court did note that LAION was not controlled by any private company and had no preferential deals (which would have disqualified it under § 60d(2) sentence 3).[63] Still, the outcome prompted calls for clearer guidelines on what evidence an organisation must show to be deemed a '*Forschungsorganisation*' beyond simply registering as a non-profit.

A particularly striking critique comes from legal scholars like Prof. Tim W. Dornis, who argue that the training of generative AI models is **not** actually covered by the text-and-data mining exceptions at all.[64] Dornis suggests that the EU legislator, in drafting Articles 3 and 4 DSM Directive, envisioned TDM mainly as a knowledge-discovery or

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[57]Hoeren (n 2) (describing the Hamburg decision as an early/first European reference point).
[58]See eg Vossius & Partner (n 6); Bird & Bird (n 5).
[59]See eg Baumann M, 'Generative KI und Urheberrecht – Urheber und Anwender im Spannungsfeld' (2023) 76(51) NJW 3673; Böhme and Pesch (n 54).
[60]Rosati (n 3).
[61]DSM Directive recital 12 and art 2(1); UrhG § 60d(2).
[62]Rosati (n 3); Hoeren (n 2) (raising concerns about 'quasi-research' actors).
[63]Landgericht Hamburg (n 1); UrhG § 60d(2) sentence 3.
[64]Dornis TW, 'The training of generative AI is not text and data mining' (2025) 47(2) EIPR 65–78; Dornis TW, 'The Training of Generative AI Is Not Text and Data Mining' (SSRN, 2024) <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4862039>.

analytical tool—for example, text mining to find patterns in scientific literature—rather than the wholesale ingestion of creative works to generate new content via AI.[65]

According to this view, when an AI like Stable Diffusion or ChatGPT is trained on images or text, it is doing more than 'mining'; it is effectively memorising expressive elements, and this process (and certainly the subsequent use of the trained model) may implicate reproduction and making available rights in ways not excused by the narrow TDM exceptions.[66] In a forthcoming article, Dornis goes so far as to conclude that unlicensed AI training is copyright infringement *pure and simple*, and that only licences or a broad fair use doctrine (absent in EU law) could legitimise it.[67]

While the Hamburg court did not take such a restrictive stance—it assumed TDM exceptions can cover AI training, at least in the initial data-gathering phase—this academic perspective underscores a tension: whether AI model training was meant to be subsumed under 'text and data mining' or whether it is an entirely new use case beyond what lawmakers contemplated. The *LAION* judgment seems to read 'data mining' generously, to include using data for machine learning, but future courts (or the CJEU) might be persuaded by arguments that the systematic ingestion of millions of artistic works pushes the exceptions to a breaking point, especially if the result is that models can emit content that substitutes for the original works.

Another German commentary by Pesch and Böhme in 2023 (written prior to the case) had anticipated many of these issues, dubbing the scenario '*Artpocalypse now?*' in reference to generative AI's ability to replicate training images.[68] They examined whether reproducing training images could be justified under existing law and highlighted uncertainties in how courts would interpret the scope of TDM privileges.

The Hamburg decision provides one important data point, but it is not the final word. The litigation has now reached the Hanseatic Higher Regional Court of Hamburg (OLG Hamburg), which on 10 December 2025 dismissed the appeal and upheld the dismissal of the injunction claim. In doing so, the OLG shifted the analytical centre of gravity towards § 44b UrhG (general TDM) and, in particular, the requirement that opt-outs be expressed in machine-readable form under § 44b(3) sentence 2 UrhG; it nonetheless confirmed that § 60d UrhG (scientific research) would, on the facts, also justify the use. The OLG admitted a further appeal on points of law (Revision) to the Federal Court of Justice (BGH), underscoring that key thresholds remain doctrinally live.[69]

Until then, the *LAION* ruling stands as a reference—influential but not binding beyond the case—and it is being watched closely across Europe. If other EU courts confront similar disputes (and given the proliferation of AI, it is likely they will), they may take guidance from Hamburg or choose to diverge. For example, a court might more strictly enforce the limitation that datasets created under a research exception should not be openly accessible beyond the project, or might require more proof that a particular data scraping activity is part of a scientific study (such as an affiliation with a university project, publication of research results, etc.).

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[65]ibid. Dornis argues that the EU legislator envisioned TDM primarily as a knowledge-discovery tool rather than a mechanism for wholesale ingestion of creative works to train generative models.

[66]Tim W Dornis, 'Generative AI, Reproductions Inside the Model, and the Making Available to the Public' (2025) 56(6) IIC – International Review of Intellectual Property and Competition Law 623 (forthcoming). Available at Springer Link.

[67]Dornis TW, 'Generative AI, reproductions inside the model, and the making available to the public' (2025) 56(5) IIC 909–938; Dornis (n 62).

[68]Paulina J Pesch and Rainer Böhme, 'Artpocalypse now? – Generative KI und die Vervielfältigung von Trainingsbildern' (2023) 125(14) GRUR 997–1007.

[69]Hanseatisches Oberlandesgericht Hamburg (n 76) 1, 11, 18 and 32.

4.3 Interplay with the EU AI Act

The interplay with the **EU AI Act** is worth mentioning. The EU's AI Act (Regulation (EU) 2024/1689) regulates certain aspects of AI development and might indirectly affect copyright issues.[70] Notably, Article 53(1)(a) of the AI Act mandates that providers of General-Purpose AI Models prepare and regularly update technical documentation for their models. This documentation must cover the model's training and testing processes, as well as the outcomes of its evaluations. Providers are also required to supply these documents to the AI Office and national competent authorities upon request.[71]72

Particularly relevant to this essay is point 2(c) of Annex XI of the EU AI Act (entitled: 'technical documentation referred to in Article 53(1), point (a)—Technical documentation for providers of General-Purpose AI models'), which elaborates on the technical documentation obligations outlined in Article 53(1)(a).[73] It requires providers to include a comprehensive overview of the model's components, including details about the datasets used for training, testing, and validation. This includes the type and origin of the data, data curation practices (such as cleaning and filtering), the volume, scope, and key characteristics of the data, and how it was sourced and selected.

However, the technical documentation obligation does not apply to providers of AI models released under a free and open-source licence that allows for 'the access, usage, modification, and distribution of the model, and whose parameters, including the weights, the information on the model architecture, and the information on model usage, are made publicly available'.[74] Even though this exception could apply to research organisations, assuming that their models are released under a free and open-source licence, it does not apply to general-purpose AI models with systemic risks.

Moreover, it is worth noting that all the General-Purpose AI model providers also have the obligation to prepare and regularly update a comprehensive summary that includes the content used for training of the general-purpose AI model, following the template that we expect will be published by the AI Office in due time (Article 53(1)(d) of the EU AI Act). Relatedly, the governance rules and obligations for general-purpose AI (GPAI) models, that include the requirement mentioned above, will start to apply as of 2 August 2025, whereas the majority of the AI rules, including those for high-risk AI systems, will largely become applicable as of 2 August 2026.

Delving into the recitals of the EU AI Act will be particularly relevant when discussing the interplay between the AI Act and intellectual property considerations.[75] Recital 104 clarifies that releasing general-purpose AI models under a free and open-source licence does not necessarily disclose meaningful information about the datasets used for training or fine-tuning the model, nor about the measures taken to ensure compliance with copyright law. This is why the exception to comply with transparency-related requirements does not apply to the overarching requirement of introducing a

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[70]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) [2024] OJ L, 2024/1689, 12.7.2024, art 53(1).

[71]Dimitrios Devetzis and Simos Samaras, 'Consumer Protection Safeguards after the AI Act' (2024) 13(2) Perspectives of Law and Public Administration 298–309.

72Dimitrios Devetzis and Simos Samaras, 'E-Commerce Platforms and Liability in the AI Era' (2024) 4(1) International Investment Law Journal 19–29.

[73]ibid art 53(1)(a) and Annex XI, point 2(c), requiring comprehensive documentation of training data including type, origin, curation practices, volume, scope, and selection methodology.

[74]ibid art 53(2), exempting providers of AI models released under free and open-source licences from certain documentation requirements, except for general-purpose AI models with systemic risks.

[75]ibid recitals 104–109, which address the interplay between AI transparency obligations and intellectual property rights, including copyright compliance requirements.

compliant policy with EU copyright law, including with respect to identifying the reservation rights found in Article 4(3) of the DSM Directive.[76]77

Further, Recital 105 acknowledges the dynamic nature of large generative AI models on the one hand, and challenges to artists, authors, and other creators on the other hand. The challenge pertains to how the content of these rightsholders is used, distributed, and otherwise handled. There is an inherent conflict here, especially since AI development and training by default requires access to vast amounts of data; this is in essence the fuel that unleashes their capabilities. Naturally, the mining techniques deployed to acquire such data may clash with relevant copyright protections that require the authorisation of the rightsholder concerned unless relevant limitations apply.

Recital 106 serves as a reminder that every provider of general-purpose AI models in the EU must comply not only with the AI Act, but with corresponding laws and regulations including with respect to copyright, and the DSM Directive.[78] An area of particular pertinence is when identifying the reservation rights pursuant to Article 4(3) of the DSM Directive. As such, any provider who places a general-purpose AI model in the EU must fulfil this obligation regardless of the jurisdiction they are based in. The underlying reason for this is that no provider should be discriminated against another by virtue of being active in an EU Member State with lesser copyright standards and protections. By creating an equal ground for every provider, the AI Act ensures consistency and certainty across the board, and aims at a straightforward approach throughout.

Apart from the more detailed summary that may be provided to the AI Office on request, subject to the exceptions previously discussed, there is the obligation to produce another detailed summary of the data used to train the general-purpose AI model. The summary should be thorough, while also safeguarding trade secrets and protecting confidential business information. A key detail here is that one of the purposes of the summary, apart from informing the general public, is to provide adequate information to facilitate the parties 'with legitimate interests, including copyright holders, to exercise and enforce their rights'.[79] For example, the summary may include a list of the primary datasets or collections used to train the model. The AI Office is expected to issue a template for this summary. Additionally, the AI Office will oversee whether providers have met these requirements, though it will not assess copyright compliance for each individual dataset. Importantly, the EU AI Act does not interfere with the enforcement of copyright rules established under EU law (Recital 108).

The *LAION* case, by emphasising the need (or lack thereof) to heed opt-outs, feeds into this narrative. If LAION had been found to violate copyright, it might signal that current practices are unlawful—but since LAION was vindicated (for non-commercial research use), the AI Act's requirement will press future developers to either align with those conditions (partner with research organisations or ensure an exception applies) or secure licences where they do not. In short, the legal landscape is evolving, and the *LAION* judgment is one piece of a larger puzzle concerning how AI innovation can coexist with the rights of authors in the age of data-driven creativity.

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[76]Dimitrios Devetzis, 'The New EU Product Liability Directive. Interaction with Parallel EU Initiatives: Proposed AI Liability Directive, Digital Services Act and Digital Markets Act' in Dimitrios Devetzis, Dana Volosevici and Leonidas D Sotiropoulos (eds), Digital Lawscapes: Artificial Intelligence, Cybersecurity and the New European Order (ADJURIS – International Academic Publisher, Bucharest/Paris/Calgary 2025).

77Dimitrios Devetzis, 'AI, Sustainability Law and EU AI Act' (2024) 14(3) Journal of Regional Socio-Economic Issues 18–26.

[78]ibid recital 106, emphasising that all providers of general-purpose AI models in the EU must comply with EU copyright law, including identifying rights reservations under DSM Directive art 4(3).

[79]ibid recital 107, clarifying that training data summaries should facilitate rightsholders' ability to exercise and enforce their rights.

4.4 Ethical and Social Implications

Beyond the legal intricacies, the *LAION* case spotlights significant ethical and social questions about AI training data and the rights of creators. On one side of the debate are the innovators and researchers who argue that broad access to data is essential for AI progress. LAION's mission to create an open, public dataset was motivated by a desire to democratise AI research—to allow even those without corporate resources to train models, and to improve transparency about what goes into AI systems.

From this perspective, the Hamburg court's decision can be seen as ethically sound: it upholds a practice that contributes to scientific knowledge and technological advancement. If every use of data for AI required individual licences or carried a high risk of litigation, the concern is that only the largest companies (with deep pockets to clear rights or pay damages) could develop AI, leading to a monopolisation of AI power. By affirming a legal safe harbour for non-profit research-oriented data use, the court arguably protected the public interest in innovation and academic freedom.

Indeed, organisations like LAION view themselves as part of an *open science* movement, treating data as a commons for the greater good. Some ethicists would further argue that using publicly available data (especially lower-resolution or watermarked images, as was the case here) does minimal harm to the author, while the benefit to society from AI progress (new medical imaging techniques, improved accessibility tools, etc.) could be substantial—a utilitarian justification.

On the other side are the content creators—photographers, artists, writers—who increasingly feel that their work is being appropriated to fuel AI systems with little respect or compensation for their labour. The plaintiff Kneschke's reaction to the verdict was one of disappointment; he and many in the creative community see the ruling as effectively condoning the mass '**scraping**' of creative works under the guise of research. The ethical concern is that an artist's control over their own work is eroded: an image they shared on a platform (perhaps intending it for licensed sale or controlled use) can end up in a giant dataset used to train AI models that might even compete with the artist's own market.

There is also a moral rights aspect—even if not legally addressed here—where artists feel a violation of the personal bond to their work when it is ingested by AI without consent. The fact that LAION's dataset was later used by commercial AI projects (like Stability AI's image generator) exacerbates the sense of unfairness: the fruits of the artist's creativity get leveraged by others to create new works or services, potentially displacing the original creators.

These concerns have led to public outcry and calls for better protection. For example, professional photographers' associations (like FREELENS in Germany) have criticised the Hamburg decision, suggesting it undermines photographers' rights and that the law should require at least a possibility for authors to say 'no' to such uses. Even if the court found the opt-out clause was not binding in this case, the very presence of that clause ('no automated downloading') indicates the photographer's wish—which was effectively overridden. Ethically, one might argue, should not the clearly expressed intent of the creator count for something? This touches on principles of autonomy and respect: creators feel disrespected when their wishes are ignored due to legal technicalities.

The *LAION* case also raises issues of trust and public perception in AI. If people come to see AI models as built on uncompensated exploitation of human creativity, this could fuel backlash against AI generally. Already the term 'data poisoning' or coordinated opt-outs are floated as ways for artists to fight back (e.g., withdrawing their works or tagging them to prevent inclusion in AI datasets). There have been instances of artists demanding their works be removed from training sets and even lawsuits in the United States and UK by artists and agencies against AI companies for copyright infringement.

While those cases involve different legal doctrines (like the US fair use analysis),[80] they echo the fundamental social question: should AI developers *ask* before using someone's creative output, and if so, how to facilitate that? One idea gaining traction is developing industry standards or platforms for licensing data for AI—for example, a system where creators could opt in and perhaps receive micropayments when their work is used to train a profitable AI. The *LAION* ruling, by firmly placing LAION's use under a research exception, essentially sidesteps the compensation question in that context (non-profit research traditionally does not pay royalties for using works in analysis, similar to how libraries or academics might use works under fair dealing). But it leaves open what happens when the line blurs between research and commercial use.

From a social perspective, there is also the question of cultural impact: if AI models trained on massive datasets of human-made art can produce new images or text, what does that do to the creative industry's economics and incentives? Some argue it could undermine original creators' livelihoods, creating an ethical imperative to ensure they are not unfairly sacrificed for technological progress. Others note that historically, new technologies (from photography to sampling in music) have always challenged existing creative norms, and the law has had to adapt to strike a balance.

We see preliminary attempts at balance in the EU's approach: by allowing research-oriented mining but letting rightsholders opt out of commercial mining, the DSM Directive tried to thread a needle between innovation and control. The *LAION* case tested that compromise and, depending on one's viewpoint, either affirmed its viability or exposed its loopholes. Ethically, the notion of '**benefit-sharing**' is relevant—if AI brings huge benefits (including financial) using authors' works, should those authors share in the benefits? The current legal framework does not provide a mechanism for that, aside from voluntary licensing or collective bargaining (some talk of extending collective licensing to AI training, akin to how radio stations pay royalties for songs).

Finally, the case touches on transparency and consent. Many creators were not even aware their works were in training datasets until tools were developed to search the LAION database for one's images. The lack of transparency (until after the fact) strikes some as ethically problematic. The upcoming AI Act's transparency requirements might improve this by forcing disclosure of training data sources for large models, effectively alerting rightsholders. But then, what can a creator do if they find their work was used? Under the *LAION* precedent, if it was done by a qualifying research body without commercial intent, the answer is: nothing, it was lawful.

This could incentivise creatives to lobby for changes in the law, perhaps to narrow exceptions or introduce a right to remuneration for such uses (similar to how authors in some jurisdictions have a right to remuneration for private copying via levy systems). From a societal viewpoint, a balance should be struck such that researchers can continue advancing AI in beneficial ways while artists do not feel their value is being usurped. The ethical debate is far from settled, but *LAION* has certainly made it more concrete, prompting discussions in Germany and beyond about whether the current copyright framework adequately addresses the realities of AI training.

Update on appeal (OLG Hamburg, 10 December 2025). Since the completion of this manuscript, the Hanseatic Higher Regional Court of Hamburg (OLG Hamburg) has dismissed the photographer's appeal and upheld the first-instance dismissal of the injunction claim.[81] While the Regional Court's analysis had centred on scientific research,

[80]See eg Authors Guild v Google, Inc., 804 F.3d 202 (2d Cir. 2015), finding book-scanning for search indexing to be fair use under US copyright law.

[81]Hanseatisches Oberlandesgericht Hamburg, Urteil vom 10. Dezember 2025 – 5 U 104/24 (Kneschke v LAION e.V.), 1 (Berufung zurückgewiesen; Revision zugelassen) <https://itm.nrw/wp-content/uploads/2025/12/5_U_104_24_Urteil.pdf>.

the OLG placed the general TDM framework in § 44b UrhG (implementing Article 4 DSM Directive) at the core of its reasoning and treated the contested download and automated image–text matching as "text and data mining"; the claimant's reservation of rights was held ineffective because it was not expressed in machine-readable form within the meaning of § 44b(3) sentence 2 UrhG.[82] The OLG further indicated that—on the facts—the use was also independently justified under § 60d UrhG (scientific research), including notwithstanding downstream availability to commercial actors, absent a determining influence of a private undertaking.[83] The decision is not yet the last word: the OLG admitted a further appeal on points of law (Revision) to the Federal Court of Justice (BGH).[84]

5. Conclusion

The *Kneschke v LAION* decision represents a seminal moment in the evolving relationship between copyright law and artificial intelligence. Legally, it suggests that under German and EU law, the creation of AI training datasets by non-profit research-oriented entities can be accommodated within existing copyright exceptions, notably the text and data mining exception for scientific research. The Hamburg court's broad and pragmatic interpretation of § 60d UrhG illustrates a judicial attempt to reconcile traditional authors' rights with the needs of modern data-driven research, effectively carving out space for activities essential to AI development.

In doing so, the ruling provides a measure of certainty (or at least a favourable precedent) for researchers and organisations like LAION that their good-faith data mining efforts for research will not automatically land them in legal peril. It aligns with the policy trend in the EU to foster innovation (as embodied in the DSM Directive and AI Act) while still insisting on a boundary: the privilege is conditioned on non-commercial, public interest aims and is not open-ended for pure commercial exploiters.

However, the analysis also confirms that the first-instance ruling was neither the final nor the only doctrinal "anchor" for assessing AI-training datasets. As noted in the preceding update, the Hanseatic Higher Regional Court of Hamburg (OLG Hamburg) has since dismissed the appeal and upheld the dismissal of the injunction claim, while shifting the centre of gravity of the reasoning to the general TDM exception in § 44b UrhG and, in particular, to the statutory requirement that any reservation of rights must be expressed in machine-readable form under § 44b(3) sentence 2 UrhG.[85] The OLG nonetheless confirmed that—on the facts—§ 60d UrhG (scientific research) would also justify the use, including despite the dataset's potential downstream use by commercial actors absent a determining influence of a private undertaking.[86] At the same time, the OLG admitted a further appeal on points of law (Revision) to the Federal Court of Justice (BGH), underscoring that the operational thresholds for effective opt-outs and the boundary between lawful mining and downstream dissemination remain doctrinally live issues—potentially also at EU level via Article 4(3) DSM Directive.[87]

Further, it is worth noting that this is a novel area of law and jurisprudence, and regulators and judges alike are still learning the ropes. Notions including AI training,

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[82]Hanseatisches Oberlandesgericht Hamburg, Urteil vom 10. Dezember 2025 – 5 U 104/24 (Kneschke v LAION e.V.), 11 and 18 (maschinenlesbarer Nutzungsvorbehalt gem § 44b Abs. 3 S. 2 UrhG) <https://itm.nrw/wp-content/uploads/2025/12/5_U_104_24_Urteil.pdf>.

[83]Hanseatisches Oberlandesgericht Hamburg, Urteil vom 10. Dezember 2025 – 5 U 104/24 (Kneschke v LAION e.V.), 32 (§ 60d UrhG; keine Disqualifikation durch nachgelagerte kommerzielle Nutzung ohne bestimmenden Einfluss) <https://itm.nrw/wp-content/uploads/2025/12/5_U_104_24_Urteil.pdf>.

[84]Hanseatisches Oberlandesgericht Hamburg (n 76) 1 (Zulassung der Revision zum BGH).

[85]Hanseatisches Oberlandesgericht Hamburg (n 76) 11, 18.

[86]Hanseatisches Oberlandesgericht Hamburg (n 76) 32.

[87]Hanseatisches Oberlandesgericht Hamburg (n 76) 1.

research organisations, data scraping, data repurposing, and more will continue to evolve in the coming years. In that realm, the authors expect a significant uptick of litigation, and consequently court rulings, pertinent to these notions. The Hamburg decision has certainly been instrumental, but it is one of the first drops in an ocean of case law that is bound to be created in the years to come.

These notions will be ferociously litigated in the grand chambers of the European courts, including the Court of Justice of the EU (CJEU). Until the CJEU rules on some, or all, of the notions, the jury will still be out, as we colloquially say, with respect to permissible data uses and potential conflicts of intellectual property rights.

The *LAION* case has also illuminated the broader ethical landscape, underscoring that legal permissibility does not automatically equate to social acceptance. There remains a palpable tension between the tech community and the creative community. As AI continues to advance, pressure may build on lawmakers to adjust the legal framework—perhaps introducing new safeguards for creators, or conversely, expanding exceptions if current ones are seen as too restrictive. Germany and the EU will likely continue to be a testing ground for these issues, especially once the AI Act comes into force, adding another layer of regulation.

Internationally, comparisons will be drawn to how other jurisdictions handle AI training (for example, the more flexible fair use doctrine in the US, where litigation is pending over similar questions).[88] Those global developments might feed back into European discourse as well.

In conclusion, the *LAION* ruling strikes a noteworthy, if contentious, balance in favour of enabling AI research under existing copyright law. It demonstrates the adaptability of legal concepts like research exceptions to unforeseen technologies, but also highlights their limits. For AI developers and researchers, the case is an encouraging sign that courts understand the importance of data access. For authors and rightsholders, it is a cautionary tale that current laws may not fully safeguard their interests in the face of technological change—energising calls for vigilance and possibly reform.

The true legacy of *LAION* will depend on subsequent legal developments and whether a fair equilibrium can be found where innovation thrives hand in hand with respect for creative labour. As it stands, *Kneschke v LAION* is a defining early chapter in the jurisprudence of AI and copyright, one that will inform both practice and policy in the years to come.

6. Bibliography

6.1 Legislation and Treaties

Berne Convention for the Protection of Literary and Artistic Works (Paris Act, 24 July 1971, as amended 28 September 1979).

Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society [2001] OJ L 167, 22.6.2001, p. 10 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32001L0029>.

Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market [2019] OJ L 130, 17.5.2019, p. 92 <https://eur-lex.europa.eu/eli/dir/2019/790/oj>.

[88] See eg Andersen v Stability AI Ltd. (N.D. Cal.), No. 3:23-cv-00201; The New York Times Company v Microsoft Corporation et al (S.D.N.Y.), No. 1:23-cv-11195; Getty Images (US) Inc & ors v Stability AI Ltd [2025] EWHC 2863 (Ch) (UK).

Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) [2024] OJ L, 2024/1689, 12.7.2024 <https://eur-lex.europa.eu/eli/reg/2024/1689/oj>.

Germany: Urheberrechtsgesetz (UrhG), as amended by Gesetz zur Anpassung des Urheberrechts an die Erfordernisse des digitalen Binnenmarktes (UrhDaG) of 31 May 2021 (BGBl. I 2021, 1204) <https://dejure.org/BGBl/2021/BGBl._I_S._1204>.

6.2 Case Law

Authors Guild v Google, Inc., 804 F.3d 202 (2d Cir. 2015).

Kelly v Arriba Soft Corp., 336 F.3d 811 (9th Cir. 2003).

Robert Kneschke v LAION e.V., Landgericht Hamburg, Urteil vom 27 September 2024 – 310 O 227/23.

Robert Kneschke v LAION e.V., Hanseatisches Oberlandesgericht Hamburg, Urteil vom 10 December 2025 – 5 U 104/24 <https://itm.nrw/wp-content/uploads/2025/12/5_U_104_24_Urteil.pdf>.

6.3 Commentary and Secondary Sources

Baumann M, 'Generative KI und Urheberrecht – Urheber und Anwender im Spannungsfeld' (2023) 76(51) NJW 3673.

Bird & Bird, 'Long-awaited German judgment by the District Court of Hamburg in the LAION case – what does it mean for AI models' (1 October 2024) <https://www.twobirds.com/en/insights/2024/germany/long-awaited-german-judgment-by-the-district-court-of-hamburg-kneschke-v-laion>.

Bird & Bird, 'Higher Regional Court Hamburg confirms AI training was permitted (Kneschke v LAION)' (17 December 2025) <https://www.twobirds.com/en/insights/2025/germany/higher-regional-court-hamburg-confirms-ai-training-was-permitted-(kneschke-v-laion)>.

Böhme R and Pesch PJ, 'Artpocalypse now? – Generative KI und die Vervielfältigung von Trainingsbildern' (2023) 125(14) GRUR 997.

Cooper J and Grimmelmann J, 'Copyright and the Three-Body Problem' (2024) 47(4) Columbia Journal of Law & the Arts 1.

Devetzis D and Samaras S, 'Consumer Protection Safeguards after the AI Act' (2024) 13(2) Perspectives of Law and Public Administration 298–309.

Devetzis D and Samaras S, 'E-Commerce Platforms and Liability in the AI Era' (2024) 4(1) International Investment Law Journal 19–29 <https://journals.indexcopernicus.com/api/file/viewByFileId/2081836>.

Devetzis D, 'AI, Sustainability Law and EU AI Act' (2024) 14(3) Journal of Regional Socio-Economic Issues 18–26 <https://geography.aegean.gr/tinyDocs/v5files/m2hq6mo216l1i1y0jkb.pdf>.

Devetzis D, 'The New EU Product Liability Directive. Interaction with Parallel EU Initiatives: Proposed AI Liability Directive, Digital Services Act and Digital Markets Act' in Devetzis D, Volosevici D and Sotiropoulos LD (eds), Digital Lawscapes: Artificial Intelligence, Cybersecurity and the New European Order (ADJURIS – International Academic Publisher, Bucharest/Paris/Calgary 2025).

Dirks S, ‘KI-Urteil: Landgericht Hamburg weist Klage gegen “LAION 5B” ab’ (17 October 2024) <https://www.dirks.legal/2024/10/17/ki-urteil-landgericht-hamburg-weist-klage-gegen-laion-5b-ab/>.

Dornis TW, ‘Generative AI, reproductions inside the model, and the making available to the public’ (2025) 56(5) IIC 909–938 <https://doi.org/10.1007/s40319-025-01582-9>.

Dornis TW, ‘The training of generative AI is not text and data mining’ (2025) 47(2) EIPR 65–78.

Hoeren T, ‘Drei Mythen und ein Todesfall: Urheberrechtliche Fragen bei der Generierung von KI-Daten’ (14 October 2024) <https://rsw.beck.de/aktuell/daily/meldung/detail/gastkommentar-hoeren-urheberrechtliche-fragen-generierung-ki-daten-scraping>.

Kneschke R, ‘Meine Klage gegen LAION e.V. wurde in erster Instanz abgewiesen’ (21 October 2024) <https://www.alltageinesfotoproduzenten.de/2024/10/21/meine-klage-gegen-laion-e-v-wurde-in-erster-instanz-abgewiesen/>.

Kneschke R, ‘Aktueller Stand meiner Klage gegen LAION e.V.’ (22 December 2025) <https://www.alltageinesfotoproduzenten.de/2025/12/22/aktueller-stand-meiner-klage-gegen-laion-e-v/>.

Rosati E, ‘The German LAION decision: a problematic understanding of TDM and AI training’ (The IPKat, 7 October 2024) <https://ipkitten.blogspot.com/2024/10/the-german-laion-decision-problematic.html>.

Vossius & Partner, ‘Hamburg Regional Court Rules on Training Data for Artificial Intelligence – LAION case’ (16 October 2024) <https://www.vossius.eu/en/news/detail/hamburg-regional-court-rules-on-training-data-for-artificial-intelligence>.

Vossius & Partner, ‘Decision of the Higher Regional Court of Hamburg on AI Training Datasets’ (11 December 2025) <https://www.vossius.eu/en/news/detail/decision-of-the-higher-regional-court-of-hamburg-on-ai-training-datasets>.

Rosalie Edge: Life, Work and Impact

Abstract:
Rosalie Edge was a great conservation activist of the 20th century who brought innovation to the conservation movement by introducing different activist practices. She fought to bring changes to conservation policies as well as other conservation organizations which she believed had strayed from their responsibilities to preserve wildlife, especially birds in extinction. She was also an advocate for the establishment of national parks and helped in the creation of a number of them. In addition, she organized a wildlife sanctuary for migratory birds of prey, the Hawk Mountain Sanctuary, which is regarded her most well-known achievement.

Keywords:
Rosalie Edge, life, work, impact

Zoi Tampaki[1] and Evangelos Manolas[2]

[1] Zoi Tampaki, PhD student, Department of Forestry and Management of the Environment and Natural Resources, School of Agricultural and Forestry Sciences, Democritus University Thrace, 193 Pantazidou Street, 68200 Orestiada, Greece. Email: ztampaki@fmenr.duth.gr
[2] Evangelos Manolas, Professor, Department of Forestry and Management of the Environment and Natural Resources, School of Agricultural and Forestry Sciences, Democritus University Thrace, 193 Pantazidou Street, 68200 Orestiada, Greece. Email: emanolas@fmenr.duth.gr

1. Introduction

Rosalie Barrow Edge was born in England in 1877 to John Wylie Barrow and Harriet Bowen Woodward. Her family was wealthy, her father being an importer and an accountant. Rosalie Edge received her elementary education from Miss Doremus' School, a private school. She did not attend college (Famousbio, n.d.). In 1909 she married the engineer Charles Noel Edge (Sumner, 1995; Coleman, 2023). Edge spent a lot of time alongside her father in Central Park, New York. Central Park was to become a pinnacle of urban recreation parks but also the home for different types of wildlife but specifically birds. The experiences with her father in her formative years left a lasting impression on Edge (Coleman, 2023). In 1915, she and her husband bought a summer home in Rye, New York. She often went birding in Central Park, where she begun to be interested in the local bird diversity. Edge was heavily involved in the feminist movement but slowly, her interest in feminist matters was overtaken by her devotion to bird biodiversity. Her devotion to bird biodiversity led her to becoming a most determined advocate for the natural environment (Sumner 1995). In the middle of 1920s, she and her husband of 15 years separated. After separating from her husband, she continued to visit Central Park. Her interest with the lives of birds became a passion. She wrote regularly in her notebooks, focusing with increasing concern on the significance of both wildlife and its habitat (Edge P., 1999; Our Public Lands & Waters, 2025).

In Central Park she also met a lot of people (Edge P., 1999). Among them was the associate curator and biologist at the American Museum of Natural History and great friend to her throughout most of her life, Dr Willard Gibbs Van Name, who taught Edge about birding as well as introducing her to different conservation and preservation philosophies (Sumner, 1995). Van Name was the writer of the pamphlet, "A Crisis in Conservation", which was important to leading Edge to engage in environmental activism (Coleman, 2023). In addition to Van Name, who was her most important mentor, Edge was educated by other famous nature professionals such as Robert Marshall, William Temple Hornaday, J. "Ding" Darling and Aldo Leopold. Edge acquired skills in writing and advocating knowledgeably on all sorts of conservation topics. Among them were the importance of protecting birds of prey and maintaining species diversity, the dangers of toxins and pesticides, and the necessity of preserving virgin forests (Alchetron, 2024).

2. Her work in the suffrage movement

Rosalie Edge begun her journey in activism as a suffragist, playing a significant role in the passing of the Nineteenth Amendment in America in 1920 which gave women the right to vote. In particular, she was involved in the New York State Woman's Suffrage Party and after the Nineteenth Amendment was passed, she joined the League of Women Voters. But after that she found a new cause, i.e., animal conservation (Sumner, 1995). Edge's history in grassroots activism started in the fight for women's suffrage and continued with creating the Emergency Conservation Committee (ECC). The ECC's aim was to fight against injustice within the conservation movement. The ECC was created in 1929-30 and disbanded with Edge's death in 1962 (Coleman, 2023).

Edge met Sybil Thomas, a British suffragist, in February 1913, and immersed herself in the suffrage movement. She joined the Equal Franchise Society, delivered speeches and prepared pamphlets. Next, she also joined the Empire State Campaign Committee, where she met Carrie Chapman Catt. In 1915 she became corresponding secretary for the New York State Woman Suffrage Party, where she worked alongside Catt and Mary Garrett Hay (Wright, n.d.).

The suffrage movement was the forum where she learned a lot of her practices and methodology which proved crucial to her later success as an advocate for conservation. She utilized a lot of the skills she acquired during the suffrage movement. These included

organizing efficient and effective activism campaigns, giving persuasive speeches, writing pamphlets, staging protests, engaging other thought leaders. The success of her work gave her an indomitable spirit and a bottomless well of self-confidence (Coleman, 2023; Garrett, n.d.; Robbins, 2024).

3. Rosalie Edges' conservation activism

Edge became a major preservation activist in the 1930's and continued to be one until her death at age 85 in 1962. Her activism and influence are still apparent (Sumner, 1995). Edge advocated against different conservation organizations including the Audubon Society which conspired with hunters, developers, and ranchers who were in favor of bounties on bald eagles in Alaska (Audubon Center of Birds of Prey, n.d.). She also charged the National Association of Audubon Societies with squandering their funds without progressing in any tangible way in wildlife protection (Peine, 2002). She challenged for their practices a number of organizations, in particular, the Audubon Society, the United States Biological Survey and the United States Department of Forest Service (Sumner, 1995). In 1929 Edge went to the American Museum of Natural History to attend the 25th annual meeting of the Audubon Society and discuss with them the contents of the pamphlet "A Crisis in Conservation". She made known her disapproval of the bounties the society supported with regard to bald eagles in Alaska as well as the fact that the society had endorsed a bill that would have allowed people to hunt in wildlife refuges (Nijhuis, 2021). The pamphlet analyzed bird conservation but also the actions of the National Association of Audubon Societies which were contrary to bird conservation. When she returned to New York, she tried to amend the situation by forming the ECC. And because Van Name had been forbidden by his employers to publish any more pamphlets, she, in turn, started writing and publishing pamphlets on the subject under her own name on behalf of the ECC (Today in Conservation, 2022). Later, for purposes of use by the EEC, she requested the association's list of members, which, however, was not given to her. Eventually, the matter was resolved in court, with Edge winning the battle. In 1940, the association changed its name to the National Audubon Society, distanced itself from supporters of predator control and started advocating for the protection of all bird species (Nijhuis, 2021).

The ECC was created in 1929. Unlike other conservation organizations of the time, it emphasized the need "to protect all species while they were common so that they did not become rare" (Audubon Center of Birds of Prey, n.d.). The ECC was created to be a trustworthy organization to conserve and preserve the natural environment, mainly using pamphleteering (Sumner, 1995). Edge's responsibilities with regard to the ECC were being the organizer and messenger for the group and the person who handled personal letters and donations (Coleman, 2023). The ECC did not have public members but only contributors and supporters (Edge P., 1999). The fact that Edge managed to be associated with Hawk Mountain Sanctuary, Yosemite National Park, Olympic National Park, and the campaign to end the use of poison for wildlife control provided great visibility for her as a woman in the conservation movement (Furmansky, 2010). She also contributed to the establishment and protection of many major national parks which still survive today, e.g., Olympic National Park, Kings Canyon National Park, and Hawk Mountain Sanctuary. At the same time, she also protected small old growth forests of sequoias and sugar pines (Sumner, 1995; Peine, 2002). She was the head of two organizations which she started in the 1930s: the Hawk Mountain Sanctuary, which was the world's first preservation area for birds of prey, in Kempton, Pennsylvania, and the Manhattan-based Emergency Conservation Committee which was the most militant nature advocacy organization of its time (Nijhuis, 2021; Furmansky, 2010). The power of the ECC became enormous in proportion to its small income and financial resources. Each mailing was producing appropriate editorials from its supporters on the staff of prominent newspapers,

particularly the New York Times. If requested, the contributors would enthusiastically write their congressmen and other officials (Edge P., 1999).

It was 1932, when she learned that hunters would travel to a specific mountain to shoot migratory birds of prey at autumn and at spring. The anatomy of the mountain was such that it forced the birds to fly along the ridge of it due to air currents, making hunting them easier, leading to thousands of bird deaths each year (Today in Conservation, 2022). As a result of that discovery the Hawk Mountain Sanctuary was founded in 1934 and is believed to be the world's first refuge for birds of prey. The Hawk Mountain Sanctuary was significant because it was the first sanctuary of its kind in the world devoted to the protection of bird biodiversity. But Edge did not stop there, she was also very active in conservation education by disseminating knowledge to the public about conservation practices at the sanctuary. She was also very interested in teaching the younger generations about the importance of conservation generally. Edge, in order to further this cause, published several conservation education packets for school children (Sumner, 1995).

However, the creation of the Hawk Mountain Sanctuary was the most personal battle throughout her life. People at the time considered birds of prey a menace to chickens and game birds and wanted to get rid of them. Shooting them had also become very common for farmers for sport. Edge in order to control the mass hunting of the hawks bought the mountain and in the mid-1930s established the Hawk Mountain Sanctuary (Sumner, 1995). She hired Maurice and Irma Broun to serve as on-site managers. Their job was to make sure people did not trespass into the property and turn away hunters, even notify the police when necessary (Today in Conservation, 2022). Within a single migration cycle, hawk populations increased dramatically. The sanctuary became a pioneering model of conservation and served as an example to other conservationists for the protection of other species in other habitats (Popova, 2021).

Before and after the Pearl Harbor attack Edge was still fighting in the animal conservation front. At this time, the country did not want to consider the creation of any new National parks, but she continued her fight for unpopular causes such as the preservation of the natural environment, proposing alternative solutions (cattle dipping). She also advocated against the use of the area near Yellowstone National Park as an artillery range in order to protect the few trumpeter swans that remained there. However, her plea for the relocation of the range was rejected by the War Department. She finally managed to achieve her goal by sending copies of her correspondence with President Roosevelt, Vice President Harry Truman and Secretary of War Stimson to conservationists in order to convince them to take action. This she managed four days before the Pearl Harbor attack. Even when the United States finally entered the war Edge did not leave Hawk Mountain Sanctuary unguarded and when Maurice Broun enlisted in the army, she hired Fran Trembly, to replace him. She also kept asking for donations even during the war with some criticism for her timing. When the Brouns returned to Hawk Mountain, after the war, the sanctuary began to receive thousands of visitors year-round, in fact as many as five thousand visitors at a time. By the early 1950s the Hawk Mountain Sanctuary seemed to be shaping the ecological thinking of the era and often drew prominent nature writers like William Vogt, Edwin Way Teale, Sigurd Olson, O.S. Pettingill, Joseph Wood Krutch, Florence Page Jaques, and Rachel Carson (Furmansky, 2010).

Edge's conservation efforts did not only include Hawk Mountain. She also worked for the creation, protection, or expansion of Olympic, Yosemite, Sequoia, Kings Canyon, and Grand Teton national parks. She campaigned strongly for the protection of pelicans in Yellowstone. She succeeded in convincing Congress to buy thousands of acres of old-growth forests on the perimeter of Yosemite National Park which were allocated for logging (Fuzinski, n.d.).

Edge's work has not been recognized as much as it deserved. Men like George Bird Grinnell, Gifford Pinchot, Bob Marshall, John Muir, or Theodore Roosevelt enjoy much more recognition. Lakes, forests, wilderness areas, monuments, and parks have been named after them. Few people can name the person who played a key role for the protection of Olympic national park or who brought to life the world's first refuge for birds of prey (Our Public Lands & Waters, 2025).

She fought against some of the most powerful interests al local and national level. Her tactics were not quiet diplomacy or backroom deals but pamphlets, lawsuits, grassroots organizing, speaking the truth and engaging the public (Our Public Lands & Waters, 2025; Fuzinski, n.d.).

Edge has also influenced the first generation of environmentalists, including the founders of the Wilderness Society, Nature Conservancy, the Environmental Defense Fund (Levins, 2018; Furmasky, 2010).

Scientist and author Rachel Carson visited Hawk Mountain Sanctuary several times and used information on bird populations in her famous 1962 book *Silent Spring*.

4. Conclusions

Edge contributed greatly to the conservation movement and towards establishing environmental policies at a time when conservation or preservation were not given the appropriate support and attention (Sumner, 1995]. Rosalie Barrow Edge's life and work is an example of the power of individual action in facing environmental challenges. Her passion to protect our natural world, transformed wildlife preservation and led to profound environmental change. (Fuzinski, n.d.).

Rosalie Edge in one of her unpublished memoirs explains the secrets of success: "I beg each one to keep conservation as his hobby, to keep his independence, his freedom to speak his mind." Furmansky (2010), Edges' biographer, took her statement further: "She had seen too many professionals become jaded or fall captive to special interests. She, on the other hand, had spoken freely. There would always be a need for those who could do that, she warned" (Conservation Sense and Nonsense, 2014).

Considering that the word "ecosystem" did not become an indispensable part of the ecology and conservation until 1935 her work in conservation becomes even more impressive. Many scientists at the time as well as the public thought of the environment as an accumulation of many relatively unassociated and independent parts and not as part of a whole system. Edge cared about all different species which meant that she understood the importance of different ecological relationships something which, in turn, greatly differentiated her from other conservationists of her time. She fought to achieve the conservation of different species and avoid their extinction (Popova, 2021).

Towards the end of her life, she was recognized as one of the most important figures in the American conservation movement. In 1962, at the age of 85, Edge attended her last Audubon gathering in Corpus Christi, Texas, almost three weeks before her death (Nijhuis, 2021). Her approach to activism in conservation was unique at the time since she created a new methodology within the movement with the main purpose of her struggle being not economic profit but the advancement of environmental ideals (Colemen, 2023). With her the ECC died as well. And with the publication of *Silent Spring* in 1962, Rachel Carson took over the movement that in a lot of ways Edge had begun (Sumner, 1995).

5. References

Alchetron, The Free Social Encyclopedia (2024). Rosalie Edge. 7 October. Available: https://alchetron.com/Rosalie-Edge

Audubon Center for Birds of Prey (n.d.). Rosalie Barrow Edge - Feminist, naturalist and conservationist. Available: https://milliontrees.me/2014/09/12/rosalie-edge-conservation-hero/

Coleman, E.C. (2023). *Rosalie Edge and the Modern Environmental Movement.* Bachelor's Thesis. Western Kentucky University. Available: https://digital commons.wku.edu/cgi/viewcontent.cgi?article=1997&context=stu_hon_theses

Conservation Sense and Nonsense (2014). Rosalie Edge, conservation hero. 12 September. Available: Rosalie Edge, conservation hero – Conservation Sense and Nonsense

Edge, P. (1999). Rosalie Edge: A most determined lady (1877-1962). Available: https://cybrary.fomb.org/pages/Rosalie%20Edge-%20A%20Most%20Determined%20Lady%20(1877-1962)-Peter%20Edge%201980s.pdf

Famousbio (n.d.). Rosalie Edge - Women's right activist, family and life. Available: https://famousbio.net/rosalie-edge-10931.html

Garrett, L.R. (n.d.). Find a Grave, Rosalie Barrow Edge. Available: https://www.findagrave.com/memorial/160944990/rosalie-edge

Furmansky, D.Z. (2010). *Rosalie Edge, Hawk of Mercy: The Activist Who Saved Nature from the Conservationists*. Athens, GA: University of Georgia Press.

Fuzinski, P. (n.d.). Rosalie Barrow Edge's impact on wildlife conservation. Available: https://aptitudeoutdoors.com/articles/rosalie-barrow-edges-impact-on-wildlife-conservation

Levins, S. (2018). Rosalie Edge: Champion of women's suffrage and environmental activism. 19 September. Available: https://wednesdayswomen.com/rosalie-edge-champion-of-womens-suffrage-and-environmental-activism/

Nijhuis, M. (2021). Smithsonian Magazine, How Mrs. Edge saved the birds, April. Available: https://www.smithsonianmag.com/science-nature/how-mrs-edge-saved-birds-180977167/

Our Public Lands & Waters (2025). The "Hellcat" of Conservation: Rosalie Edge and the fight for the Olympic Rain Forests. 3 November. Available: https://ourpubliclandsandwaters.substack.com/p/the-hellcat-of-conservation-rosalie

Peine, A.M. (2002). Women for the wild: Douglas Edge Murie and the American Conservation Movement. Graduate Student Theses, Dissertations & Professional Papers, No. 4757. Available: https://scholarworks.umt.edu/cgi/viewcontent.cgi?article=5792&context=etd

Popova, M. (2021). The woman who saved the hawks. The Marginalian. Available: https://www.themarginalian.org/2021/04/29/rosalie-edge/

Robins, A. (2024). Rosalie Edge: The National Park founding mother you've never heard of. National Park Service. 23 May. Available: https://www.nps.gov/people/rosalie-edge.htm

Sumner, L.K. (1995). Rosalie Edge and the American Conservation Movement. Doctoral Dissertation, Oklahoma State University, Stillwater, OK. Available: https://openresearch.okstate.edu/server/api/core/bitstreams/a9aef3c2-f155-4861-b637-9b6a8dfe6335/content

Today in Conservation (2022). Rosalie Edge, conservationist and suffragette, Born (1877). Available: https://todayinconservation.com/2022/07/november-3-rosalie-edge-conservationist-and-suffragette-born-1877/

Wright, A.L. (n.d.). Biographical sketch of Rosalie Barrow Edge, included in *Part III: Mainstream Suffragists—National American Woman Suffrage Association*. Available: https://documents.alexanderstreet.com/d/1010113908

Sustainable Development in EU Law: Treaty Foundations, Legislative Framework, and Contemporary Challenges
(Enriched Edition 2025)

Abstract

This article examines sustainable development as a constitutional objective and operational principle of EU law, and argues that—beyond public environmental regulation—it increasingly functions as a driver of EU private law. Drawing on treaty foundations, the European Green Deal acquis (2020–2025) and recent measures in consumer, product, corporate due diligence and digitalisation policy, it develops the thesis of a 'sustainable market': EU private law is being re-engineered so that contracts, products and corporate value chains become vehicles for achieving environmental and social objectives. The analysis maps the legal architecture (climate governance, ETS/CBAM, nature restoration) while showing how sustainability reshapes private-law concepts such as information duties, durability, remedies, allocation of risk and liability, and private enforcement. It concludes by identifying the key challenges of implementation, coherence and legitimacy as the Union moves from green regulation to sustainability-oriented private ordering.

Keywords: sustainable development, European Union law, EU private law, European consumer law, contract law, product sustainability, corporate sustainability due diligence, circular economy, green transition, intergenerational equity, just transition, private enforcement

Dimitrios Devetzis[1], **Ioannis Voudouris**[2] **and Ioannis Giokaris**[3]

[1] Dimitrios Devetzis (Dr. iur., LL.M., M.L.E.), Assistant Professor of Law, Department of Law, Frederick University Cyprus; EU Legal Expert in Private Law – Law & Technology; e-mail: law.dd@frederick.ac.cy
[2] Ioannis Voudouris (Dr.), Assistant Professor (Commercial & Maritime Law), Department of Law, Frederick University Cyprus; e-mail:
[3] Ioannis Giokaris (Dr.), Lecturer, Department of Law, Frederick University Cyprus; e-mail: law.ig@frederick.ac.cy

1. Introduction: The Concept of Sustainable Development

The concept of *sustainable development* has become one of the most important guiding principles in contemporary legal, political, and social discourse. Its most influential and widely cited definition was introduced in the Brundtland Report of 1987, which described it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".[4] This formulation captures the intergenerational responsibility central to sustainability, while also stressing the need for balance between economic progress, environmental protection, and social justice.

The importance of sustainable development lies in its multidimensional character. Scholars and policymakers alike emphasise that sustainability rests on three interrelated pillars: the economic, the social, and the environmental.[5] Increasingly, commentators have also highlighted a fourth, ethical dimension, which reflects the moral obligations of current generations towards both the natural environment and future generations.[6] As such, sustainable development functions both as a normative principle—a set of ethical and legal standards guiding states and societies as well as a practical policy framework for governance.

In the international legal order, sustainable development gained prominence following the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992. The resulting Rio Declaration on Environment and Development and Agenda 21 underlined the necessity of integrating economic growth with environmental protection and social equity.[7] Later, the adoption of the 2030 Agenda for Sustainable Development by the United Nations General Assembly in 2015 reaffirmed these commitments, setting out 17 Sustainable Development Goals (SDGs) as a universal blueprint for peace, prosperity, and environmental integrity.[8]

The academic debate around sustainable development has expanded considerably in recent decades. Some scholars underline its potential as a transformative legal principle capable of reshaping governance structures at both national and international levels.[9] Others criticise the concept for being too broad, arguing that its inherent vagueness risks making it a mere rhetorical tool rather than a binding principle of law.[10] Nevertheless, the practical impact of sustainable development in shaping constitutional provisions, legislative instruments, and judicial reasoning across many jurisdictions—including the European Union—demonstrates that it has evolved into a genuine driver of change

The European Union (EU) has played a leading role in institutionalising sustainable development. The principle has been progressively integrated into EU treaties, strategies, and secondary legislation, making it a cornerstone of European Union action. Article 3(3) of the Treaty on European Union explicitly states that the EU "shall work for the sustainable development of Europe," linking economic growth with high levels of environmental protection and social progress.[11] Furthermore, Article 21 TEU commits the Union to

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[4]World Commission on Environment and Development, Our Common Future (Oxford University Press 1987).

[5]Jeffrey Sachs, The Age of Sustainable Development (Columbia University Press 2015), 220-225; Klaus Bosselmann, The Principle of Sustainability: Transforming Law and Governance (Ashgate 2008) 53-58.

[6]Edith Brown Weiss, In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity (United Nations University 1989), 18-22.

[7]United Nations, Rio Declaration on Environment and Development (12 August 1992) A/CONF.151/26 (Vol I); Ved P. Nanda, 'Sustainable Development, International Trade and the Doha Agenda for Development' (2005) 8 Chapman Law Review 53.

[8]UN General Assembly, Transforming Our World: The 2030 Agenda for Sustainable Development A/RES/70/1 (21 October 2015).

[9]Klaus Bosselmann, The Principle of Sustainability: Transforming Law and Governance (Ashgate 2008), 63-68.

[10]Niko Soininen, 'Vagueness of Sustainable Development as a Legal Concept' (2011) 13 Environmental Law Review 39, 40-42.

[11]Consolidated Version of the Treaty on European Union [2016] OJ C202/13, art 3(3).

promoting sustainable development in its external action, thereby embedding sustainability into both its internal and external policies.[12]

The European Sustainable Development Strategy (2001, revised 2006) provided an initial framework for integrating sustainability across EU policies, while the more recent European Green Deal (2019) represents a comprehensive attempt to achieve climate neutrality by 2050. In December 2025, the EU reached a historic provisional agreement establishing a binding target of 90% net emissions reduction by 2040, representing the most ambitious climate commitment of any major economic bloc.[13] These developments confirm that sustainable development is no longer a peripheral concept but a constitutional principle of the European Union, guiding legislative, judicial, and policy decisions.[14]

2. The Notion of Sustainable Development in Law and Legislation

A. Treaty Foundations

The concept of sustainable development did not feature in the original founding treaties of the European Communities. Early integration was focused primarily on economic union and the establishment of the common market. Environmental and social concerns entered the legal order only gradually, reflecting broader international developments in the late twentieth century, particularly the growing recognition of sustainability following the Brundtland Report (1987)[15] and the Rio Earth Summit (1992).[16] Against this background, the EU began to integrate sustainable development into its constitutional structure through successive treaty reforms.

The Treaty of Maastricht (1992) represented the first important milestone. Maastricht not only created the European Union as a political entity but also expanded the competences of the Community in the field of environmental protection. Article 2 of the Treaty on European Community (TEC) stated that the Community's task included "a harmonious and balanced development of economic activities" and "a high level of protection and improvement of the quality of the environment".[17] This formulation reflected the emerging global consensus that environmental protection and economic growth must be considered together. As Krämer notes, Maastricht "introduced the idea that environmental protection was not an optional extra but a constitutive element of the European project".[18]

The Treaty of Amsterdam (1997) significantly deepened this integration by explicitly inserting sustainable development into the objectives of the Union. The new Article 2 TEC declared that the European Community should "promote ... a high level of employment and of social protection, equality between men and women, sustainable and non-inflationary growth respecting the environment".[19] Moreover, the new Article 6 TEC (now Article 11 TFEU) required that environmental protection be integrated into all Union policies with a view to promoting sustainable development.[20] Today, this provision appears as Article 11 of the Treaty on the Functioning of the European Union (TFEU), which maintains that "environmental protection requirements must be integrated into the definition and

[12]Consolidated Version of the Treaty on European Union [2016] OJ C202/13, art 21.
[13]European Commission, The European Green Deal COM (2019) 640 final; European Council, 2040 Climate Target: Council and Parliament agree on 90% emissions reduction (10 December 2025).
[14]Ludwig Krämer, EU Environmental Law (8th edn, Sweet & Maxwell 2023) 41-46; Joanne Scott, 'Sustainable Development and EU Law: A Normative Reassessment' in Marise Cremona (ed), New Governance and the European Union: Legal Perspectives (OUP 2005) 211-214.
[15]World Commission on Environment and Development, Our Common Future (OUP 1987), 43.
[16]Philippe Sands and Jacqueline Peel, Principles of International Environmental Law (4th edn, CUP 2018), 54-56.
[17]Treaty on European Union (Maastricht, 1992) [1992] OJ C191/1, art 2 TEC, 117.
[18]Ludwig Krämer, EU Environmental Law (8th edn, Sweet & Maxwell 2023), 49.
[19]Treaty of Amsterdam Amending the Treaty on European Union (1997) [1997] OJ C340/1, 88-89.
[20]Treaty of Amsterdam [1997] OJ C340/1, art 6 TEC, 102.

implementation of the European Union's policies and activities, in particular with a view to promoting sustainable development".[21] This integration principle—often described as the "green mainstreaming clause"—transformed sustainability from a policy aspiration into a legally binding consideration for EU decision-making.[22]

The process of embedding sustainability within the realm of constitutionalism was consolidated in the Treaty of Lisbon (2007), which entered into force in 2009. Article 3(3) TEU now provides that the European Union "shall work for the sustainable development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and improvement of the quality of the environment".[23] The breadth of this provision shows how sustainable development functions as a bridging principle, reconciling economic, social, and environmental objectives. French highlights that the Lisbon formulation reflects the EU's ambition to treat sustainability as a constitutional metaprinciple, guiding the interpretation of competences across all policy areas.[24]

In addition to the objectives set out in the TEU, the Lisbon Treaty reinforced the principle of integration by introducing Article 11 TFEU. This provision obliges the Union to ensure that environmental protection is not treated in isolation but is incorporated into the design and execution of all European Union policies and activities, with the overarching aim of advancing sustainable development.[25] This provision is particularly important because it requires policymakers to not only consider sustainability in environmental legislation but also to integrate it into other fields such as agriculture, transport, and energy. As Scott explains, Article 11 TFEU effectively enshrines a "horizontal legal duty" that obliges EU institutions to mainstream sustainability across the entire acquis.[26]

The Charter of Fundamental Rights of the European Union, which became legally binding through the Lisbon Treaty, further consolidates sustainability at the constitutional level. Article 37 of the Charter provides: "A high level of environmental protection and the improvement of the quality of the environment must be integrated into the policies of the Union and ensured in accordance with the principle of sustainable development".[27] While the Charter is primarily concerned with fundamental rights, the inclusion of sustainability demonstrates its normative weight in the EU constitutional order. As Lee observes, the Charter gives sustainability a "rights-adjacent character," situating it alongside human dignity, equality, and solidarity.[28]

B. Secondary Legislation and the Operationalisation of Sustainable Development

The constitutional provisions enshrining sustainable development in the Treaties would remain abstract if not for the extensive body of secondary legislation that translates them into binding rules. Through directives, regulations, and decisions, the European Union has operationalised sustainability across multiple sectors of policy. As Krämer notes, "the backbone of EU environmental and sustainability law lies in the dense network of secondary legislation, which has given real substance to treaty principles".[29]

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[21]Consolidated Version of the Treaty on the Functioning of the European Union [2016] OJ C202/47, art 11.
[22]Maria Lee, EU Environmental Law, Governance and Decision-Making (2nd edn, Hart Publishing 2014), 221-223.
[23]Consolidated Version of the Treaty on European Union [2016] OJ C202/13, art 3(3).
[24]Duncan French, International Law and Policy of Sustainable Development (Manchester UP 2005) 39-40.
[25]Consolidated Version of TFEU [2016] OJ C202/47, art 11.
[26]Joanne Scott, 'Sustainable Development and EU Law' in Cremona (ed), New Governance and the European Union (OUP 2005) 214-216.
[27]Charter of Fundamental Rights of the European Union [2012] OJ C326/391, art 37.
[28]Maria Lee, EU Environmental Law (2nd edn, Hart 2014), 38.
[29]Ludwig Krämer, EU Environmental Law (8th edn, Sweet & Maxwell 2023), 112.

A central example is the Environmental Impact Assessment (EIA) Directive, first adopted in 1985 and later codified in Directive 2011/92/EU[30], as amended by Directive 2014/52/EU.[31] The directive requires that projects likely to have significant environmental effects—such as motorways, power plants, or airports—be subject to prior environmental assessment. Its purpose is not to prevent development but to ensure that environmental considerations are integrated into planning decisions.[32] Another cornerstone is the Strategic Environmental Assessment (SEA) Directive 2001/42/EC, which extends assessment obligations to plans and programmes. Lee has argued that the EIA and SEA together form "the procedural constitution of European sustainability".[33]

Beyond environmental procedure, energy law has become a flagship area for embedding sustainability. The Renewable Energy Directive (EU) 2018/2001 obliges Member States to increase their share of renewables in the energy mix. As Peeters points out, EU renewable energy law "translates the abstract commitment to sustainability into concrete market-shaping rules," forcing Member States and private actors to invest in greener technologies.[34]

C. The European Climate Law and the 2040 Target

Sustainability has become a defining feature of the European Union's climate policy framework, most prominently through the European Climate Law (Regulation (EU) 2021/1119). This landmark Regulation sets in legally binding terms the EU's objective of achieving climate neutrality by 2050 and codifies the interim target of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels.[35]

The Climate Law must be read together with earlier climate and energy instruments. Directive 2009/29/EC amended the EU Emissions Trading System (ETS) to strengthen carbon pricing mechanisms,[36] while the Renewable Energy Directive (2018/2001/EU) requires Member States to achieve binding renewable energy targets.[37] Scholars such as Morgera and Kulovesi observe that by embedding long-term climate goals in a binding regulation, the EU has elevated sustainability to the level of a normative backbone of its legal order.[38] Peeters similarly argues that the Climate Law "locks in" the decarbonisation trajectory of the Union by reducing political discretion.[39]

The Regulation also has important procedural dimensions. Article 6 requires the Commission to assess Union and Member State measures every five years to ensure consistency with the climate neutrality objective, while Article 7 mandates the establishment of a European Scientific Advisory Board on Climate Change.[40] As Kulovesi notes, these mechanisms "institutionalise accountability" by embedding scientific expertise and regular

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[30]Directive 2011/92/EU on environmental impact assessment [2012] OJ L26/1.
[31]Directive 2014/52/EU [2014] OJ L124/1.
[32]Ludwig Krämer, EU Environmental Law (8th edn, 2023), 57.
[33]Maria Lee, EU Environmental Law (2nd edn, 2014), 97-99.
[34]Marjan Peeters, 'Legislation on Renewable Energy and the EU Internal Market' (2010) 19 European Energy and Environmental Law Review 406.
[35]Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality ('European Climate Law') [2021] OJ L243/1, arts 1-4.
[36]Directive 2009/29/EC amending Directive 2003/87/EC on greenhouse gas emission allowance trading [2009] OJ L140/63.
[37]Directive (EU) 2018/2001 on the promotion of renewable energy [2018] OJ L328/82, art 3.
[38]Elisa Morgera and Kati Kulovesi, 'The EU and International Climate Change Law' in Cremona and Scott (eds), EU Law Beyond EU Borders (OUP 2019) 225.
[39]Marjan Peeters, 'The European Climate Law: Institutionalising the Decarbonisation Trajectory' (2021) 30 European Energy and Environmental Law Review 110.
[40]Regulation (EU) 2021/1119 [2021] OJ L243/1, arts 6-7.

monitoring into the legal architecture of sustainability.[41] At the same time, Oberthür warns that while the Climate Law represents a major step, its effectiveness ultimately depends on the robustness of implementing measures.[42]

3. The December 2025 Agreement on the 2040 Climate Target

On 10 December 2025, the Council and the European Parliament reached a provisional political agreement to amend the European Climate Law by setting a 2040 EU-wide climate target of a 90% net reduction of greenhouse gas emissions compared with 1990 levels. The agreement also envisages limited use of high-quality international credits (up to 5%) from 2036 and stronger governance provisions, while preserving the binding 2030 and 2050 trajectories. Because the deal is provisional, it still requires formal adoption and may remain politically contested.[43]

Even as a provisional agreement, the 2040 target matters for private law. It reshapes the regulatory baseline for investment, product design and consumer markets, and it strengthens the case for reading sustainability-related duties in consumer and corporate directives as part of an integrated transition strategy. At the same time, the parallel 'simplification' agenda illustrates the tension between competitiveness and sustainability, suggesting that EU private law will remain a site of contestation over how far market actors should be mobilised to deliver climate objectives.[44]

4. The Expansion of Emissions Trading and the Carbon Border Adjustment Mechanism

The EU Emissions Trading System has undergone its most significant structural changes since inception. The revised ETS (Directive (EU) 2023/959) now operates with an annual cap reduction of 4.3% through 2027, increasing to 4.4% from 2028-2030, targeting 62% reduction by 2030 versus 2005 levels. The December 2025 Carbon Market Report confirmed that ETS-covered emissions are now approximately 50% below 2005 levels, with power sector emissions falling 11% in 2024 alone. Revenue generation reached €38.8 billion in 2024, bringing cumulative ETS revenues above €250 billion.[45][46]

Maritime transport integration represents the most significant sectoral expansion. From 1 January 2024, ships of 5,000 gross tonnage or more entering EU ports face coverage requirements, with first allowance surrender due 30 September 2025. The greater than 99% compliance rate in the first year demonstrates successful implementation despite industry concerns.

The Carbon Border Adjustment Mechanism concluded its transitional reporting phase on 31 December 2025. Beginning 1 January 2026, only authorised CBAM declarants may import covered goods, with certificate purchases commencing February 2027.[47] The October 2025 simplification introduced a de minimis threshold exempting importers of fewer than 50 tonnes annually, reducing administrative burden for approximately 182,000 small importers

[41]Kati Kulovesi, 'A New Era of EU Climate Law: The European Climate Law in Context' (2021) 10 Transnational Environmental Law 111, 119.

[42]Sebastian Oberthür, 'Hard or Soft Governance? The EU Climate Law in International and Domestic Context' (2022) 31 European Energy and Environmental Law Review 338.

[43]Council and European Parliament provisional agreement (10 December 2025) on an amendment to the European Climate Law setting a 2040 EU climate target of 90% net greenhouse-gas reductions compared with 1990, including limited use of international credits.

[44]Directive (EU) 2024/1760 on corporate sustainability due diligence (CSDDD/CS3D) and the 2025 'Omnibus' simplification agenda affecting sustainability reporting and due diligence timetables and scope.

[45]European Commission, 2025 Carbon Market Report: EU ETS lowers power sector emissions and expands to maritime transport (3 December 2025).

[46]European Commission, Carbon Market Report 2025 (COM(2025) 735 final, 3 December 2025) and related Commission communications on ETS performance and revenues.

[47]Regulation (EU) 2023/956 establishing a carbon border adjustment mechanism [2023] OJ L130/52.

while capturing over 99% of embedded emissions.[48] This mechanism represents an innovative approach to preventing carbon leakage while maintaining the integrity of the EU's climate ambition.

5. Corporate Sustainability Due Diligence: Ambition Meets Political Reality

The trajectory of the Corporate Sustainability Due Diligence Directive (CSDDD) exemplifies the tensions between sustainability ambition and business competitiveness concerns. Directive (EU) 2024/1760, adopted in April-May 2024, established mandatory human rights and environmental due diligence across value chains.[49] However, the implementation timeline has been substantially extended through the 'Stop-the-Clock' Directive and the December 2025 Omnibus package, which restructured the Directive's fundamentals: scope thresholds increased to 5,000 employees and €1.5 billion turnover; transposition deadline extended to July 2028; and, most significantly, the climate transition plan obligation (Article 22) was eliminated entirely.[50]

The removal of the climate transition plan obligation is particularly significant, as it eliminates the Directive's primary climate governance mechanism. This development illustrates an important tension within EU sustainability law: while the legal architecture has become increasingly sophisticated, political pressures—particularly those framed in terms of competitiveness and administrative burden—can substantially dilute implementation. The broader harmonisation principle in the revised Directive also limits Member States' ability to maintain more stringent national requirements, affecting existing legislation like Germany's Lieferkettensorgfaltspflichtengesetz.

6. The Nature Restoration Regulation: A Landmark Achievement

The Nature Restoration Regulation (Regulation (EU) 2024/1991), which entered into force on 18 August 2024, represents one of the most significant achievements of EU environmental law in recent years. Following one of the most contentious adoption processes in EU environmental law history—secured only by a minimum qualified majority after Austria's Environment Minister controversially broke with her coalition partner—this directly applicable Regulation establishes the EU's first legally binding nature restoration targets.[51]

The Regulation requires 30% of degraded habitats to be restored by 2030, rising to 60% by 2040 and 90% by 2050. Additional targets include restoration of at least 25,000 km of rivers to free-flowing state by 2030, no net loss of urban green space and tree canopy cover compared to 2024 baseline, reversal of pollinator population decline by 2030, and agricultural peatland rewetting targets.[52] Member States must submit National Restoration Plans by mid-2026, covering restoration needs, timelines, and financing mechanisms. This Regulation demonstrates that, despite political resistance, the EU remains capable of adopting ambitious environmental legislation with binding, measurable targets.

7. Evolving Climate Jurisprudence

Recent judicial developments have significantly strengthened the enforceability of EU environmental law. The most consequential judgment came in ClientEarth & Collectif Nourrir v. European Commission (October 2025), where the Court ruled the Commission was wrong to approve France's CAP Strategic Plan, finding France breached conditionality requirements regarding crop rotation. This marks the first time civil society organisations won a case

[48]European Commission, Officially published: Simplifications for CBAM (20 October 2025).
[49]Directive (EU) 2024/1760 on corporate sustainability due diligence [2024] OJ L2024/1760.
[50]Greenberg Traurig LLP, 'EU Omnibus Package Trilogue Agreement on EU CSRD and CSDDD' (December 2025).
[51]Regulation (EU) 2024/1991 on nature restoration [2024] OJ L2024/1991.
[52]IUCN Briefing, EU Nature Restoration Regulation (August 2024).

establishing that an EU institution failed to comply with environmental law—a precedent with significant implications for future enforcement actions.[53]

Beyond EU law, the European Court of Human Rights' KlimaSeniorinnen v. Switzerland ruling (April 2024) found positive obligations under Article 8 ECHR to protect citizens from climate change impacts.[54] While not EU law, this precedent intersects with EU Member State obligations and may influence future CJEU reasoning on the fundamental rights dimensions of climate policy. The Committee of Ministers found Switzerland has not demonstrated compliance as of March 2025, underscoring the practical enforceability of climate-related human rights obligations.

8. The Implementation Gap: Progress and Challenges

The quantitative picture presents both achievement and concern. The European Environment Agency's November 2025 Trends and Projections report confirms 37% net emissions reduction from 1990 levels by 2024, with year-on-year decline of approximately 2.5%.[55] However, the trajectory toward 2030 targets shows strain: achieving the 55% reduction target requires nearly double the historical annual reduction rate. The gap between current status (37%) and target (55%) represents 18 percentage points to be achieved in approximately five years.

Sectoral analysis reveals stark disparities. The energy supply sector delivered 9% emissions reductions in 2024, driven by renewable expansion—electricity generation reached 47% renewable in 2024, with first-half figures exceeding 50% for the first time.[56] Conversely, transport emissions increased 0.7%, buildings showed stagnation, and the LULUCF carbon sink remained well below the 2030 target. The EEA projects 54% reduction by 2030 with additional measures versus 47% with existing measures—leaving the 55% target achievable but demanding accelerated implementation.[57]

9. Sustainable Development and EU Private Law: From Market Integration to a 'Sustainable Market'

Sustainable development now operates as a horizontal corrective of EU private law: market integration is increasingly conditioned on sustainability outcomes, and private-law instruments are drafted to allocate transition risks and costs across value chains. The result is a shift from a purely autonomy-and-efficiency narrative to a governance narrative, where contracts, products and consumer choices become regulatory interfaces for climate and biodiversity objectives.

This hybridisation is visible in three moves. First, sustainability is translated into mandatory information duties and a ban on misleading green claims, coupled with substantive rights to durability and repair. Second, product conformity is recalibrated towards sustainability by design—embedding circularity, reparability and traceability (including product passports) into the notion of a conforming good or service. Third, enforcement is progressively decentralised: collective redress, representative actions and tort-style claims operate as compliance multipliers alongside public supervision.

A. Sustainable development as a horizontal corrective in EU private law. EU private law was originally built to remove barriers to trade and to approximate national contract and consumer rules for the functioning of the internal market. In the Green Deal era, sustainable

[53]ClientEarth & Collectif Nourrir v. European Commission (General Court, October 2025).
[54]KlimaSeniorinnen v. Switzerland (ECtHR, April 2024) Application no. 53600/20.
[55]European Environment Agency, Total net greenhouse gas emission trends and projections in Europe (November 2025).
[56]Ember, European Electricity Review 2025 (January 2025).
[57]Ember, European Electricity Review 2025 (data on the EU electricity mix, including the renewable share in 2024).

development operates as a horizontal corrective: it supplies an additional normative parameter for interpreting harmonised private-law instruments and for designing new default rules. The resulting shift is not merely thematic ('more green rules'), but structural: sustainability becomes a criterion for allocating private-law risks and duties across the supply chain.[58]

10. Consumer law and the green transition: information duties, durability and remedies

The EU has moved from a pure 'information paradigm' to a combined model of information, durability and repairability. The Directive on empowering consumers for the green transition strengthens rules against greenwashing and introduces sustainability-related information duties, while the right-to-repair framework reinforces remedies that keep products in use longer. Read together with the Sale of Goods and Digital Content directives, the emerging consumer acquis links sustainability to core private-law concepts: conformity, updates, remedies, and the burden of proof for defects.[59]

11. Product sustainability, safety and liability: from design obligations to market accountability

The Ecodesign for Sustainable Products framework exemplifies 'sustainability by design': it pushes sustainability requirements upstream to product design and data (e.g., product passports), but its effectiveness ultimately depends on downstream private-law enforcement. This is where product safety and liability regimes interact with sustainability objectives. The new EU Product Liability Directive and the General Product Safety Regulation, together with sectoral ecodesign duties, support a model in which sustainability failures may translate into legal responsibility—especially where misleading environmental claims, premature obsolescence or unsafe 'green' design choices cause damage.[60]

12. Corporate sustainability due diligence and supply chains: private governance through contracts

Corporate sustainability due diligence and sustainability reporting rules institutionalise a 'contractual cascade'. Companies translate public-law due diligence duties into private instruments—supplier codes, warranties, audit rights, termination clauses and indemnities—thereby turning contracts into compliance vectors. This contractualisation of sustainability raises classical private-law questions (good faith, control of standard terms, allocation of verification costs, and third-party beneficiary effects) and will likely shape litigation strategies in cross-border value chains.[61]

13. Digitalisation, AI and 'green-by-code' private ordering

Digital regulation increasingly intersects with sustainability. Smart contracting and AI-enabled compliance tools can reduce transaction costs of traceability, reporting and verification, but they also risk entrenching opacity and asymmetries if 'code' substitutes legal

[58]Treaty foundations: Treaty on European Union (Art 3(3) TEU); Treaty on the Functioning of the European Union (notably Arts 11, 114 and 169 TFEU); and the Charter of Fundamental Rights of the EU (Art 37). These provisions allow sustainable development to function not only as a policy goal, but as an interpretative principle with spill-over effects in harmonised private law.

[59]Directive (EU) 2024/825 on empowering consumers for the green transition (amending the Unfair Commercial Practices Directive 2005/29/EC and the Consumer Rights Directive 2011/83/EU).

[60]Regulation (EU) 2024/1781 establishing a framework for setting ecodesign requirements for sustainable products (Ecodesign for Sustainable Products Regulation – ESPR).

[61]Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859 (OJ L, 5 July 2024). European Commission, COM(2025)81, 26 February 2025 (Omnibus I simplification package revising CSRD/CSDDD). See also Dimitrios Devetzis, 'The Role of Private Law in Sustainable Development: Improving Sustainability Through an Effective Anagnosis of U.S. Contract Law' (Sustainable Development, Culture, Traditions (SDCT), vol 5A/2024) 66–71 (DOI: 10.26341/issn.2241-4002-2024-5a-6-T02068).

interpretation and human accountability. The EU's AI and data governance agenda therefore becomes indirectly relevant to sustainable private ordering, particularly in consumer markets and supply-chain contracting.[62]

14. Private enforcement: collective redress, green claims and climate-related tort

Sustainability-oriented private law is incomplete without enforceable remedies. Representative actions, consumer injunctions and damages claims for misleading environmental practices, as well as climate-related tort litigation, function as complementary enforcement channels. In this sense, EU private law does not simply 'follow' sustainability regulation—it actively co-produces compliance by enabling private actors (consumers, NGOs, competitors and affected communities) to police sustainability commitments.[63]A complementary route is personality-based private-law protection, which has been used to safeguard the cultural environment through right-to-personality claims and thereby widens sustainability enforcement beyond classic consumer redress.64

15. The Social Dimension of Sustainable Development

Sustainable development generates profound social implications, as it is not limited to environmental protection or economic growth but also concerns the well-being, rights, and opportunities of people. For sustainability to succeed, vulnerable groups within societies must be protected, and equitable access to resources must be ensured. Governments, intergovernmental organisations, and civil society actors are therefore required to design and implement programmes that enable large segments of the population to escape poverty, overcome exclusion, and participate meaningfully in development processes.[65]

The social pillar of sustainability is operationalised through distributional choices: who bears the costs of decarbonisation, who enjoys the benefits of cleaner technologies, and which groups receive protection against energy poverty, exclusion and labour-market displacement. A 'just transition' is therefore not a political slogan but a legal requirement for the durability of climate and sustainability reforms.

Without a just-transition logic, sustainability measures become politically brittle: regulatory costs that intensify inequality trigger resistance, strategic litigation, and compliance avoidance, undermining both effectiveness and legitimacy. EU social policy instruments and private-law protections (eg consumer safeguards against energy poverty) therefore function as enabling conditions for environmental ambition.

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[62]Dimitrios Devetzis, 'AI, Sustainability Law and EU AI Act' (JRSEI, vol 14, issue 3, September 2024) 18–26; Dimitrios Devetzis, 'Internet of Things (IoT) and its Impact on the Development of Environmentally Sustainable Cities: Assuring Data Privacy while Developing Eco-Healthy Living' in Roido Mitoula (ed), 1st Open-Air Cities International Conference "Local and Regional Sustainable Development and Urban Reconstruction" (Harokopio University of Athens, 16–18 February 2024): Book of Abstracts (Open-Air Cities Institute, Athens 2024) 154.

[63]Directive (EU) 2020/1828 on representative actions for the protection of the collective interests of consumers provides a procedural backbone for collective enforcement of sustainability-related consumer rights (including green claims).

[64]Dimitrios Devetzis, 'Implementing the Protection of Cultural Environment in the Scope of Application of the Right to Personality' in Roido Mitoula (ed), 1st Open-Air Cities International Conference "Local and Regional Sustainable Development and Urban Reconstruction" (Harokopio University of Athens, 16–18 February 2024): Book of Abstracts (Open-Air Cities Institute, Athens 2024) 84; Dimitrios Devetzis, 'Η προβληματική της προστασίας του πολιτιστικού περιβάλλοντος ως αυτοτελώς προστατευόμενου εννόμου αγαθού στο πλαίσιο της ΑΚ 57: Εισαγωγικοί προβληματισμοί' in Eliza Alexandridou, Evgenia Alexandropoulou-Aigyptiadou and Petros Alikakos (eds), Τιμητικός Τόμος για την Καθηγήτρια Γιάννα Καρύμπαλη-Τσίπτσιου (Sakkoulas, Athens–Thessaloniki–Komotini 2022) 337 ff; Dimitrios Devetzis, 'Ιδιωτικό δίκαιο και προστασία πολιτιστικού περιβάλλοντος: Όψεις της προβληματικής, στη νομολογία των πολιτικών δικαστηρίων' in Despoina I Klavanidou, Evaggelia Koutoupa-Regkakou and Dimitrios Kostopoulos, Ζητήματα νομικής προστασίας του περιβάλλοντος (Athanasios G Georgiadis (scientific ed), Etairia Nomikon Boreiou Ellados series 66, Sakkoulas, Athens 2011).

[65]UN General Assembly, Transforming Our World: The 2030 Agenda A/RES/70/1 (21 October 2015) 17-19.

A further dimension concerns social justice and equality. Sustainable development requires fair distribution of the benefits of economic growth, addressing both intra-generational and inter-generational equity.[66] The EU has increasingly framed sustainability in terms of a "just transition", ensuring that climate policies do not disproportionately harm vulnerable workers or regions. The European Just Transition Mechanism (2020) provides financial assistance to communities most affected by the transition to a low-carbon economy.[67]

Public health is another crucial social implication. Scholars such as Gostin and Friedman have stressed that sustainable development cannot be pursued in isolation from health policy, since resilience requires an integrated approach.[68] Education and awareness also form part of the social dimension. As Nasibulina points out, creating a "noosphere person"—an individual aware of humanity's ecological limits—is one of the most ambitious yet necessary social tasks of our time.[69]

16. Ethical Dimension of Sustainable Development

One of the most fundamental aspects of sustainable development is its ethical dimension. Sustainability, as expressed in the Brundtland Report, emphasised that development must take into consideration all people who will be born after us. Each citizen needs to share the belief that he/she is an active member of a global community, and his/her actions can consequently affect the rights and well-being of future generations.[70]

The ethical principles of sustainability prescribe that when tensions exist between pillars of sustainable development—such as economics and society, or ethics and economy—decision-makers must consider both competing concepts and adopt solutions that optimise across both areas. Consider the example of automation: airports worldwide are now equipped with automated machines for passenger identification, causing employee dismissals as companies reduce costs. Using only economic principles, such behaviour is easily justified. However, if we take into consideration both ethical and economic principles, legislators might impose limits on automation to maintain meaningful employment alongside efficiency gains.

The moral dimension also encompasses the stance that all human beings must have towards the environment. All humans need to proceed to actions that take into consideration the environment and decrease harmful effects such as greenhouse emissions, air and water pollution, and depletion of natural resources.[71] The goal of modern education should be to create individuals who adhere to good moral values, understand deeply the harmful environmental effects of human activities, and are able to find viable and sustainable solutions.

17. Environmental Aspects of Sustainable Development

One of the main dangers that the environment has faced in recent decades is that various industries use oil, natural gas, and other fuels to produce energy, releasing greenhouse gases such as carbon dioxide that increase global temperatures and cause climate change.[72] For sustainable development to occur and better protect the environment, industries and states need to use alternative forms of energy such as solar and wind energy.

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[66]Edith Brown Weiss, 'Intergenerational Equity: A Legal Framework' (1990) 81 AJIL 21-23.
[67]European Commission, The Just Transition Mechanism COM (2020) 22 final.
[68]Lawrence O Gostin and Eric A Friedman, 'UN Sustainable Development Goals' (2015) 15 Global Health Law Journal 134.
[69]Anastasia Nasibulina, 'Education for Sustainable Development' (2015) 7 Journal of Education and Practice 14.
[70]Liene Amantova-Salmane, 'Ethical Aspects of Sustainability' Journal of Social Sciences 1(7), 5-15.
[71]Ashok Kumar Verma, 'Sustainable Development and Environmental Ethics' (2019) 10 International Journal on Environmental Sciences 1.
[72]Abdeen Mustafa Omer, 'Energy Efficiency Improvement' (2014) IJRSB 2(1), 11-38.

An important study showed that direct investment in 27 European States helped reduce gas emissions to a significant extent, with major investments focusing on renewable sources of energy and technological advancements aimed at advancing industries while protecting the environment.[73] The European Union, through various initiatives, envisages offering comprehensive environmental protection to European citizens, with measures serving multiple purposes such as combating pollution and promoting protective legislation.[74]

A close cooperation between the various actors of the global community—from civic movements, international and European organisations, national governments, multinational companies to Non-Governmental Organisations and environmental associations—is necessary to achieve the desired outcomes. We have reached a critical point, and sustainable and urgent solutions must be adopted if we want to see actual and concrete results.

18. Conclusions

The 2024–2025 period consolidated the European Green Deal's legislative architecture, from climate governance and carbon pricing to nature restoration, but it also marked a qualitative turn: sustainability is now embedded in private relationships through consumer, product and corporate due diligence instruments. The emerging 'sustainable market' model uses private law—contracts, liability and remedies—as a delivery system for public sustainability objectives. Yet the Omnibus simplification agenda and divergent implementation across Member States show that this embedding remains politically and legally contested.[75]

For scholarship, three dynamics deserve attention. First, the interaction between macro-level public targets (2030/2050 trajectories and carbon pricing) and micro-level private-law rules (durability, repair, green claims and supply-chain contracting) creates a new problem of coherence: how to prevent fragmentation and 'tick-box' compliance. Second, enforcement is becoming hybrid: administrative supervision is complemented by private enforcement (collective redress, consumer injunctions and climate-related tort litigation). Third, digitalisation—AI tools, data and smart contracting—can facilitate traceability and compliance, but it also raises issues of transparency, accountability and distributive justice.[76]

Ultimately, the Union's ability to deliver sustainable development will depend not only on ambitious targets, but on whether EU private law can translate those targets into credible incentives and remedies for market actors. If sustainability remains an external 'public' constraint, the implementation gap will persist; if it is internalised as a normative standard of private ordering, EU private law may become one of the strongest levers of the transition.[77]

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[73]Onofrei et al., 'The Impact of Environmental Effects of Sustainable Development' (2023) Scientific Annals of Economics and Business 70, 33-42.

[74]Lucretia Dogaru, 'The Importance of Environmental Protection and Sustainable Development' (2013) Procedia - Social and Behavioral Sciences 93, 1344-1348.

[75]Directive (EU) 2024/1760 on corporate sustainability due diligence (CSDDD/CS3D) and the 2025 'Omnibus' simplification agenda affecting sustainability reporting and due diligence timetables and scope.

[76]Directive (EU) 2020/1828 on representative actions for the protection of the collective interests of consumers provides a procedural backbone for collective enforcement of sustainability-related consumer rights (including green claims).

[77]Treaty foundations: Treaty on European Union (Art 3(3) TEU); Treaty on the Functioning of the European Union (notably Arts 11, 114 and 169 TFEU); and the Charter of Fundamental Rights of the EU (Art 37). These provisions allow sustainable development to function not only as a policy goal, but as an interpretative principle with spill-over effects in harmonised private law.

19. Sources and Bibliography

19.1 Primary Sources and Reference

19.2 EU Treaties and Charter

Consolidated Version of the Treaty on European Union [2016] OJ C202/13

Consolidated Version of the Treaty on the Functioning of the European Union [2016] OJ C202/47

Charter of Fundamental Rights of the European Union [2012] OJ C326/391

Treaty on European Union (Maastricht, 1992) [1992] OJ C191/1

Treaty of Amsterdam [1997] OJ C340/1

Treaty on European Union (consolidated version), Art 3(3) TEU (sustainable development) and related provisions.

Treaty on the Functioning of the European Union (consolidated version), notably Arts 11, 114, 169 and 191–193 TFEU.

Charter of Fundamental Rights of the European Union, Art 37 (environmental protection).

19.3 EU Regulations

Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality ('European Climate Law') [2021] OJ L243/1

Regulation (EU) 2024/1991 on nature restoration [2024] OJ L2024/1991

Regulation (EU) 2023/956 establishing a carbon border adjustment mechanism [2023] OJ L130/52

Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions [2018] OJ L156/26

Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality (European Climate Law) and amending Regulations (EC) No 401/2009 and (EU) 2018/1999.

Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism (CBAM), as amended by Regulation (EU) 2025/2083.

Regulation (EU) 2024/1991 on nature restoration (Nature Restoration Law).

Regulation (EU) 2024/1781 establishing a framework for setting ecodesign requirements for sustainable products (ESPR).

Regulation (EU) 2023/988 on general product safety (GPSR)

Regulation (EC) No 864/2007 on the law applicable to non-contractual obligations (Rome II).

Cafaggi, Fabrizio, writings on private regulation and European private law (selected articles).

Collins, Hugh, writings on European contract law, governance and regulation (selected works).

19.4 EU Directives

Directive (EU) 2024/1760 on corporate sustainability due diligence [2024] OJ L2024/1760

Directive (EU) 2023/959 amending Directive 2003/87/EC (EU ETS) [2023] OJ L130/134

Directive (EU) 2018/2001 on renewable energy [2018] OJ L328/82

Directive 2011/92/EU on environmental impact assessment [2012] OJ L26/1

Directive 2009/29/EC amending Directive 2003/87/EC (EU ETS) [2009] OJ L140/63

Directive 2001/42/EC on strategic environmental assessment [2001] OJ L197/30

Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC (EU ETS), as amended, inter alia, by Directive (EU) 2023/959.

Directive 2005/29/EC concerning unfair business-to-consumer commercial practices (UCPD), as amended.

Directive 2011/83/EU on consumer rights, as amended.
Directive (EU) 2024/825 on empowering consumers for the green transition (amending Directives 2005/29/EC and 2011/83/EU).
Directive (EU) 2024/1799 on common rules promoting the repair of goods ('Right to Repair').
Directive (EU) 2019/771 on certain aspects concerning contracts for the sale of goods.
Directive (EU) 2019/770 on certain aspects concerning contracts for the supply of digital content and digital services.
Directive 93/13/EEC on unfair terms in consumer contracts.
Directive (EU) 2024/2853 on liability for defective products (Product Liability Directive).
Directive (EU) 2024/1760 on corporate sustainability due diligence (CSDDD/CS3D).
Directive (EU) 2022/2464 as regards corporate sustainability reporting (CSRD).
Directive (EU) 2020/1828 on representative actions for the protection of the collective interests of consumers.

19.5 International instruments

UN General Assembly, Transforming Our World: The 2030 Agenda for Sustainable Development A/RES/70/1 (21 October 2015)
United Nations, Rio Declaration on Environment and Development (12 August 1992) A/CONF.151/26 (Vol I)

19.6 Court decisions

ClientEarth & Collectif Nourrir v. European Commission (General Court, October 2025)
Case C-66/23 Elliniki Ornithologiki Etaireia (CJEU, September 2024)
Case C-318/23 Commission v. Slovenia (CJEU, May 2025)
KlimaSeniorinnen v. Switzerland (ECtHR, April 2024) Application no. 53600/20
ECtHR (Grand Chamber), Verein KlimaSeniorinnen Schweiz and Others v Switzerland, Judgment of 9 April 2024.

19.7 EU official publications and reports

European Commission, The European Green Deal COM (2019) 640 final
European Commission, The Just Transition Mechanism COM (2020) 22 final
European Commission, 2025 Carbon Market Report (December 2025)
European Council, 2040 Climate Target Agreement (10 December 2025)
European Environment Agency, Trends and Projections Report (November 2025)
Ember, European Electricity Review 2025 (January 2025)
World Commission on Environment and Development (Brundtland Commission), Our Common Future (Oxford University Press, 1987).
European Commission, Carbon Market Report 2025 (COM(2025) 735 final, 3 December 2025).
European Environment Agency, Trends and Projections in Europe 2025: Tracking Progress towards Europe's Climate and Energy Targets (EEA Report, 2025).

19.8 Books and edited volumes

Bell S, McGillivray D, Pedersen O, Lees E and Stokes E, Environmental Law (10th edn, OUP 2024)
Bosselmann K, The Principle of Sustainability: Transforming Law and Governance (Ashgate 2008)
Boyle A and Freestone D (eds), International Law and Sustainable Development (OUP 1999)
Brown Weiss E, In Fairness to Future Generations (United Nations University 1989)
Chalmers D, Davies G, Monti G and Heyvaert V, European Union Law (4th edn, CUP 2024)

French D, International Law and Policy of Sustainable Development (Manchester UP 2005)
Hesselink, Martijn W., The New European Private Law: Essays on the Future of Private Law in Europe (Kluwer Law International, 2002).
Kingston S, Heyvaert V and Townley C, European Environmental Law (CUP 2023)
Krämer L, EU Environmental Law (8th edn, Sweet & Maxwell 2023)
Lee M, EU Environmental Law, Governance and Decision-Making (2nd edn, Hart 2014)
Micklitz, Hans-W., The Politics of Justice in European Private Law: Social Justice, Access Justice, Societal Justice (Cambridge University Press, 2018).
Sachs J, The Age of Sustainable Development (Columbia UP 2015)
Sands P and Peel J, Principles of International Environmental Law (4th edn, CUP 2018)
Weatherill, Stephen, EU Consumer Law and Policy (selected editions).
World Commission on Environment and Development, Our Common Future (OUP 1987)

19.9 Journal Articles

Amantova-Salmane L, 'Ethical Aspects of Sustainability' Journal of Social Sciences 1(7), 5-15
Brown Weiss E, 'Intergenerational Equity: A Legal Framework' (1990) 81 AJIL 21
Devetzis, Dimitrios, 'AI, Sustainability Law and EU AI Act' (JRSEI, Vol 14, Issue 3, September 2024) 18–26.
Devetzis, Dimitrios, 'The Role of Private Law in Sustainable Development: Improving Sustainability Through an Effective Anagnosis of U.S. Contract Law' (Sustainable Development, Culture, Traditions (SDCT), Vol 5A/2024) 66–71 (DOI: 10.26341/issn.2241-4002-2024-5a-6-T02068).
Dogaru L, 'The Importance of Environmental Protection and Sustainable Development' (2013) 93 Procedia - Social and Behavioral Sciences 1344
Ember, European Electricity Review 2025 (2025).
Gostin L and Friedman E, 'UN Sustainable Development Goals' (2015) 15 Global Health Law Journal 134
Kulovesi K, 'A New Era of EU Climate Law' (2021) 10 Transnational Environmental Law 111
Kulovesi K, Oberthür S, van Asselt H and Savaresi A, 'The European Climate Law: Strengthening EU Procedural Climate Governance?' (2024) 36 Journal of Environmental Law 179
Murphy K, 'The social pillar of sustainable development' (2012) 8(1) Science, Practice and Policy 15
Nasibulina A, 'Education for Sustainable Development' (2015) 214 Procedia - Social and Behavioral Sciences 1077
Oberthür S, 'Hard or Soft Governance? The EU Climate Law' (2022) 31 EEELR 338
Onofrei M et al., 'The Impact of Environmental Effects' (2023) 70 Scientific Annals of Economics and Business 33
Peeters M, 'The European Climate Law: Institutionalising the Decarbonisation Trajectory' (2021) 30 EEELR 110
Soininen N, 'Vagueness of Sustainable Development as a Legal Concept' (2011) 13 Environmental Law Review 39
Verma A K, 'Sustainable Development and Environmental Ethics' (2019) 10 Int'l Journal on Environmental Sciences 1

19.10 Book chapters and conference proceedings

Devetzis, Dimitrios, 'Implementing the Protection of Cultural Environment in the Scope of Application of the Right to Personality' in Roido Mitoula (ed), 1st Open-Air Cities International Conference "Local & Regional Sustainable Development and Urban Reconstruction", 16–18 February 2024, Book of Abstracts (Open-Air Cities Institute 2024) 84 (ISBN: 978-618-87070-0-9).

Devetzis, Dimitrios, 'Internet of Things (IoT) and its Impact on the Development of Environmentally Sustainable Cities: Assuring Data Privacy While Developing Eco-Healthy Living' in Roido Mitoula (ed), 1st Open-Air Cities International Conference "Local & Regional Sustainable Development and Urban Reconstruction", 16–18 February 2024, Book of Abstracts (Open-Air Cities Institute 2024) 154 (ISBN: 978-618-87070-0-9).

Δεβετζής Δημήτριος, 'Η προβληματική της προστασίας του πολιτιστικού περιβάλλοντος ως αυτοτελώς προστατευόμενου εννόμου αγαθού στο πλαίσιο της ΑΚ 57: Εισαγωγικοί προβληματισμοί' στο Ελίζα Αλεξανδρίδου/Ευγενία Αλεξανδροπούλου-Αιγυπτιάδου/Πέτρος Αλικάκος κ.ά. (επιμ.), Τιμητικός Τόμος για την Καθηγήτρια Γιάννα Καρύμπαλη-Τσίπτσιου, τόμ. 1 (Εκδόσεις Σάκκουλα 2022).

Δεβετζής Δημήτριος, 'Ιδιωτικό δίκαιο και προστασία πολιτιστικού περιβάλλοντος: Όψεις της προβληματικής, στη νομολογία των πολιτικών δικαστηρίων' στο συλλογικό έργο «Ζητήματα νομικής προστασίας του περιβάλλοντος» της Εταιρείας Νομικών Βορείου Ελλάδος (τεύχος 66, Εκδόσεις Σάκκουλα 2011) 107 επ.

CO_2 emissions, energy consumption, and economic growth in Greece, Turkey, and Israel (1978 - 2018): A Multifaceted Approach using Descriptive Statistics, Spearman Correlation, and Decoupling Analysis.

Abstract

This study examines the relationships between CO_2 emissions, energy consumption, and economic growth in the economies of Greece, Turkey, and Israel. Drawing on a comprehensive dataset covering four decades (1978–2018), we employ three (3) widely used and easily interpretable techniques—Descriptive Statistics, Decoupling Analysis, and the Spearman Correlation coefficient—to quantify and compare the interconnections among key environmental, energy, and economic variables and indices. The empirical results reveal markedly divergent sustainability trajectories across the three countries. Turkey and Israel succeeded in achieving strong decoupling between energy consumption and economic growth in the post-2008 period. In contrast, Greece displayed a pattern of recessive decoupling, strongly linked to the structural repercussions of the financial crisis. Spearman correlation analysis demonstrates that CO_2 emissions are positively correlated with income in all cases. At the same time, Total Factor Productivity plays a differentiated role: in Turkey and Israel, it is positively associated with renewable energy penetration, supporting more sustainable development pathways, whereas in Greece, a negative correlation points to structural inefficiencies and transitional obstacles. The paper concludes with relevant policy implications and future research directions.

Keywords: Decoupling analysis, Spearman correlation, Descriptive Statistics, energy consumption, CO_2 emissions, economic growth.

JEL: Q43 – Energy and the Macroeconomy**, Q56** – Environment and Development; Environment and Trade; Sustainability; Environmental Accounts and Accounting**, C32** – Time-Series Models; Dynamic Quantile Regressions; Dynamic Treatment Effect Models

Emmanouil Hatzigeorgiou[1]

[1] Emmanouil Hatzigeorgiou. Corresponding author at: Institute of Urban Environment & Human Resources, Department of Economic & Regional Development, Panteion University, 29 Aristotelous Street, GR-17671, Kallithea, Athens, Greece. E-mail address: manoschatz1981@gmail.com

1. Introduction

Environmental degradation and global warming have become important factors threatening the sustainable development of the world's economy and society (Zhang et al., 2017). Numerous studies have confirmed that the main causes of global warming were greenhouse gas emissions (GHG) and primarily energy-related CO_2 emissions (Jiang et al., 2019; Lin and Raza 2019). A large body of literature investigates the correlation between CO_2 emissions, energy consumption, and economic growth using different methodological approaches (Lv et al., 2019; Debone et al., 2021; Aghdam et al. 2023). Analyzing the decoupling progress or correlations between economic output and energy consumption and exploring the driving factors that lead to the change in CO_2 emissions have been the focal point of relevant studies (Wiedenhofer et al., 2020; Wang and Zhang, 2022). Characteristically, the work of Wang and Su (2020) examined the extent of decoupling in 192 countries from 2000 to 2014 and found that most developed countries have achieved relative decoupling and are moving towards absolute decoupling, while most developing countries have not. Similar comparisons between developed and developing countries have been provided by Wu and Zhu (2018). Other researchers employed the Pearson correlation coefficient test to determine the direction and strength of the correlation between two variables (Asuero et al., 2006). This method has been widely used in energy economics studies, evaluating the linear association between continuous variables (e.g. Li et al., 2022; Tian et al., 2022).

This study uses Descriptive data analysis, Decoupling Analysis, and Spearman's correlation test to outline the evolution and correlations of the key indicators that link CO_2 emissions, energy consumption, and economic growth in Greece, Turkey, and Israel. We applied these techniques for the 1978-2018 timespan and compared the results for the three selected countries. The study contributes to the existing literature in several ways. First, we use two well-established ease-of-use and result interpretation techniques to investigate critical energy, environmental, and economic parameters and link them with sustainable development paths by ensuring energy security. Second, the proposed methodology incorporates the index of total factor productivity (Tfp) as a driving factor of energy consumption and CO_2 emissions. Although it is accepted that Tfp growth is one of the most important dynamics in explaining economic growth (Miller and Upadhyay, 2000; Jerzmanowski, 2007), energy consumption and the Tfp nexus have a relatively shallow literature (Tugcu and Tiwari, 2016). Third, the countries under investigation have not been explicitly studied in the energy and environmental literature. The authors aspire to fill this gap and offer new insights into the design of future policies by highlighting the relationships between energy and the economy. Third, during the examined period, the three countries implemented numerous structural and functional reforms and adjustments in both its economy and energy sector. Fuerthermore, in the decade 2008-2018, Greece was hit hard by the international economic crisis, with wide-ranging economic, social, and political consequences (pegkas, 2020).

Fourth, there is a multi-dimensional need for studying the energy situation in Greece, Turkey, and Israel from a geopolitical perspective. Recent natural gas discoveries and competing pipeline projects have significantly altered regional energy dynamics (Iseri and Bartan, 2019). Moreover, their divergent environmental policies and energy strategies shape not only national trajectories but also broader patterns of regional cooperation and competition. A comparative analysis thus offers initial insights into the complex interplay between geopolitics, energy security, and environmental sustainability in the region.

Our work is structured as follows: Section 2 presents a brief literature review. Section 3 describes the proposed methodology. Section 4 shows the data analysis. Section 5 illustrates the empirical findings, while Section 6 discusses the results, provides concluding remarks, and suggests future directions.

2. Brief literature review

a. Greece

Research on the interconnection between CO_2 emissions, energy consumption, and economic growth, in Greece has yielded mixed findings. The paper of Hatzigeorgiou et al., (2011) deals with the causal relationship analysis between Gross Domestic Product (GDP), Energy Intensity, and CO_2 emissions from 1977 to 2007, based on a multivariate Vector Error Correction Modeling (VECM) and found bi-directional relationships between the examined variables. Georgantopoulos (2012) identified unidirectional causality from electricity consumption to GDP, suggesting that Greece's economy depends on energy. Dergiades et al. (2013) used econometric tests to reveal significant unidirectional linear and non-linear causal relationships between energy consumption to economic growth. Dritsaki & Dritsaki (2014) observed unidirectional causality from energy consumption to CO_2 emissions and economic growth to energy consumption, applying the Autoregressive Distributed Lag (ARDL) and VECM techniques. Roinioti and Koroneos (2017) employed Decomposition and Decoupling analysis in the major Greek economic sectors for the 2003-2013 period. They identified the energy intensity effect as the main contributor to the CO_2 emissions decrease. Simultaneously, the authors revealed that the weak decoupling progress was intercepted during the years of intense recession. Pegkas (2020) empirically investigates the relationship between energy consumption and economic growth in Greece, using annual data from 1990 to 2016. The results of the ARDL model reveal that there is a significant positive long-run effect of energy consumption, on economic growth. Gkergki (2021) using VECM, found that energy consumption hurt GDP.

Other studies have examined emissions from electricity generation (Diakoulaki et al., 2017) and the manufacturing sector (Diakoulaki et al., 2000), as well as overall national emissions (Hatzigeorgiou et al., 2010; Tsepi et al., 2024), using the Index Decomposition Analysis. They revealed that the primary catalyst for the rise in CO_2 emissions was GDP growth. Conversely, advancements in energy efficiency, as indicated by a decrease in energy intensity, significantly reduced CO_2 emissions.

b. Turkey

The paper of Kaplan et al., (2011) examines the causal relationship between energy consumption and economic growth during 1971–2006, by employing VECM. The results indicate a bidirectional causality between energy and economy. Using a cointegration test, Bozkurt and Akan (2014) examine the correlation between economic growth, CO_2 emissions, and energy consumption. The empirical results showed that CO_2 emissions hurt economic growth, whereas energy consumption has a positive effect on it. The study of Sharif et al., (2020) investigates the impact of energy consumption on ecological footprint using the QARDL model and Granger-causality tests. They found a bi-directional causal relationship between renewable energy consumption, energy consumption, and economic growth with ecological footprint in the Turkish economy. Akadiri et al., (2020) explore the relationships between carbon emissions, electricity consumption, economic growth, and globalization from 1970 to 2014, utilizing various econometric methods. The authors demonstrated that the use of fossil fuels in the energy mix is inextricably linked to environmental degradation. The recent publication of Ozdemir (2023) uses Decomposition and Decoupling analysis to examine Turkey's CO_2 emissions from electricity generation. The findings revealed that economic activity was the primary driver of CO_2 emissions, while weak decoupling was identified as the most common state of decoupling. Also, Rüstemoğlu (2024) investigates the determinants of energy use by taking a Tapio decoupling analysis and a refined Laspeyres index method. The empirical findings demonstrate that Turkey's overall energy consumption increased due to the income effect and population growth, while the energy intensity effect contributed to a decrease in energy use.

c. Israel

Regarding Israel, a country not widely studied in the energy and environmental literature, only a few studies report on energy consumption, CO_2 emissions and economic development: Magazzino and Schneider (2020) studied the causal link between primary energy consumption and economic growth. They revealed a unidirectional causality running from economic growth to primary energy consumption. The paper of Maku and Ikpuri (2020) explores the relationship between renewable energy, carbon emissions, and economic growth in a group of 8 MENA countries over the period 1990-2018. Using FMOLS and DOLS models, the authors found that renewable energy consumption had a significant negative impact on CO_2 emissions in the case of Israel.

2. Methodology

The methodological approach is mainly divided into three steps. The initial step involves the selection of primary data under investigation. We analyze the evolution of CO_2 emissions, Primary Energy Consumption (E), Renewable energy consumption (Res), population, GDP, and Tfp, and we develop the relevant indexes: Rec and Inc, based on the formulae (1) and (2):

$$Rec = \frac{Res}{Total\ energy\ consumption} \quad (1)$$

$$Inc = \frac{GDP}{Population} \quad (2)$$

We also used descriptive statistics to give a general summary of the data's features. The full data analysis is presented in Section 3.

The second step comprises the correlation analysis, employing the Spearman correlation test. The Spearman coefficient (r_s) is a nonparametric estimate of correlation that does not require the assumption of normally distributed data (Sadorsky, 2021). In this work the r_s was computed to assess the correlations between Environmental Variables (CO_2), Energy Indexes (Rec), and Socio-Economic Parameters (Inc, Tfp). Similar variables have been used in recent energy or emission analysis studies (e.g. Koilakou et al., 2024; Abbas et al., 2024; Magazzino and Mele, 2025).

CO_2 emissions reflect environmental degradation, while REC indicates an economy's progress toward green transition (Omri et al., 2022; Dagar et al., 2024). Income has been widely used in relevant literature to estimate the relationships between economic growth, energy consumption, and CO_2 emissions (e.g. Salazar-Núñez, 2020; Barrera-Santana et al., 2022; Koilakou et al., 2022). Tfp represents a modern indicator in energy analysis, depicting an important explanatory power on output and energy consumption (Jerzmanowski, 2007; Tugcu and Tiwari, 2016). The software used for the analysis is IBM SPSS Statistics 30.0.02.

Spearman coefficient provides a value between -1 and 1, where:

- 1 means a perfect positive monotonic relationship,
- -1 indicates a perfect negative monotonic relationship, and
- 0 means no relationship

A hypothesis test was then conducted to evaluate the significance of the correlation. This test aims to establish whether the observed relationship within the sample is statistically significant and can be generalized to the broader population. Consequently, two research hypotheses were proposed:

[2] https://www.ibm.com/products/spss-statistics

- Null hypothesis: H_0: r = 0, the correlation is not significantly different from 0, meaning that there is no relation between the variables.
- Alternate hypothesis: H_a: r ≠0, the correlation is significantly different from zero, meaning that there is a relation between the variables.

Finally, in the third step, we conduct a Decoupling Analysis between Total energy consumption and economic growth for Greece, Turkey, and Israel. As one of the most widely cited macroeconomic indicators for measuring sustainability through estimates of the decoupling effect, the E/GDP ratio has been the focus of many published studies (Bithas and Kalimeris, 2013). Decoupling Index (DI) is a common indicator that allows us to understand how the world, regions, and countries reduce environmental burdens (OECD 2002). For a theoretical review of decoupling models, a reader could refer to the work of Wang and Wang (2020).

We estimate the Decoupling Index (DI) for E/GDP ratio (Tapio, 2005) as follows:

$$DI_{GDP}=\frac{\Delta(E)}{\Delta(GDP)}=\frac{(E_{t_1}-E_{t0})/E_{t0}}{(GDP_{t_1}-GDP_{t_0})/GDP_{t_0}} \qquad (3)$$

The DI is interpreted as follows (UNEP, 2011):
• DI >1: coupling between the two variables.
• DI=1 is the turning point between coupling and relative decoupling.
• 0 <DI <1: relative decoupling is taking place.
• DI = 0 indicates that the economy is growing while resource consumption remains constant. This is the turning point between relative and absolute decoupling.
• DI < 0: The relationship can be described as absolute decoupling.

3. Data analysis

The period under investigation, spanning from 1978 to 2018, does not account for the impact of the COVID-19 pandemic, which is likely to have induced structural breaks in the time series under examination. Table 1 presents the variables, their definitions, and units.

Table 1. Definition of variables under investigation.

Abbreviation	Variable	Units
CO_2	Carbon dioxide emissions	Mt CO_2
E	Primary Energy Consumption	Toe[3]
Res	Renewable energy consumption	Ratio
Pop	Population	Million inhabitants
GDP	Gross Domestic Product	Million Constant 2015 US$
Tfp	Total factor productivity	Index, 2017=1

Data related to CO_2 emissions, primary energy consumption, and Res consumption are retrieved from the International Energy Agency (IEA)[4] and BP[5] databases, while data for

[3] Tonnes of oil equivalent
[4] https://www.iea.org/data-and-statistics/data-tools/climate-pledges-explorer#overview
[5] https://www.bp.com/en/global/corporate/energy-economics.html

population, GDP, and Tfp have been obtained from the World Bank[6], ensuring the accuracy and validity of the findings.

In Figs 1-6, we present the evolution of critical variables, outlining the three economies. All values are indexed in 2000 as the base year ($t_0 \equiv 2000$), according to the formulae:

$$Indexed\ Value_{t_1} = 100 + \frac{(Value\ t_1 - Value\ t_0)}{Value\ t_0} \qquad (4)$$

Fig. 1 presents the evolution of CO_2 emissions for the three economies (1978-2018).

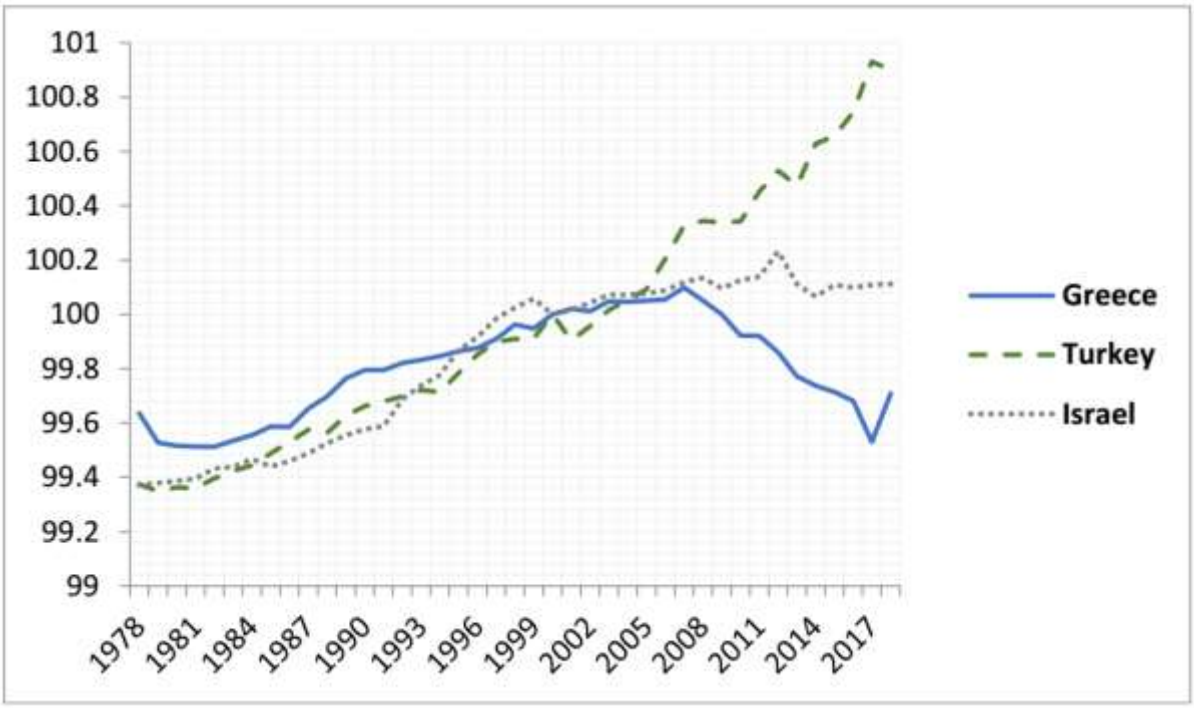

Fig. 1. CO_2 emissions for Greece, Turkey & Israel from 1978 to 2018,

All countries presented an increasing trend in CO_2 emissions until the beginning of the global economic recession. After 2007, the evolution of CO_2 emissions suggests different sustainable development paths; Greece's CO_2 emissions present a notable decline (43%); Turkey's CO_2 emissions are characterized by a strong increase of 56%; Israel shows relative stability through the period 2008-2018 (+2%).

Fig. 2 depicts energy consumption per fuel type from 1978-2018, for Greece, Turkey, and Israel.

[6] https://data.worldbank.org/

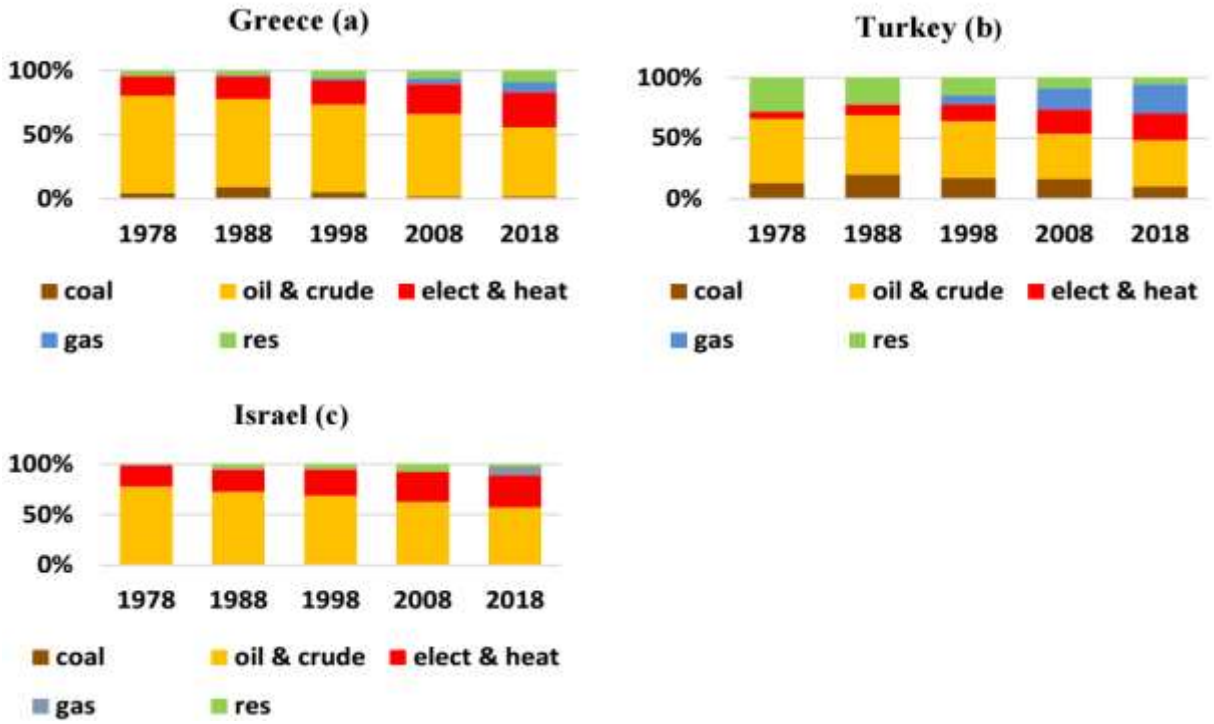

Fig. 2. Total energy consumption percentages by fuel for (a) Greece, (b)Turkey & (c) Israel in 1978, 1988, 1998, 2008, and 2018.

The consumption of oil products presents a gradual decrease for the three economies during the examined decades. This decrease is more intense for Greece (-22%) and Israel (-20,79%). Fig.2, also designates the substantial penetration of natural gas in the energy mix in the decades 1998-2008 and 2008-2018. Characteristically, the share of natural gas ranged from 7,6% in 2008 to 24,23% in 2018 for Turkey, reflecting fuel switching from oil to natural gas. The share of coal is negligible for Greece and Israel in 2008-2018, while for Turkey coal share consumption is about 10% in 2018, exhibiting a relatively stable trend from 1978 to 2018.

Fig. 3. presents the evolution of Res consumption for the three economies (1978-2018).

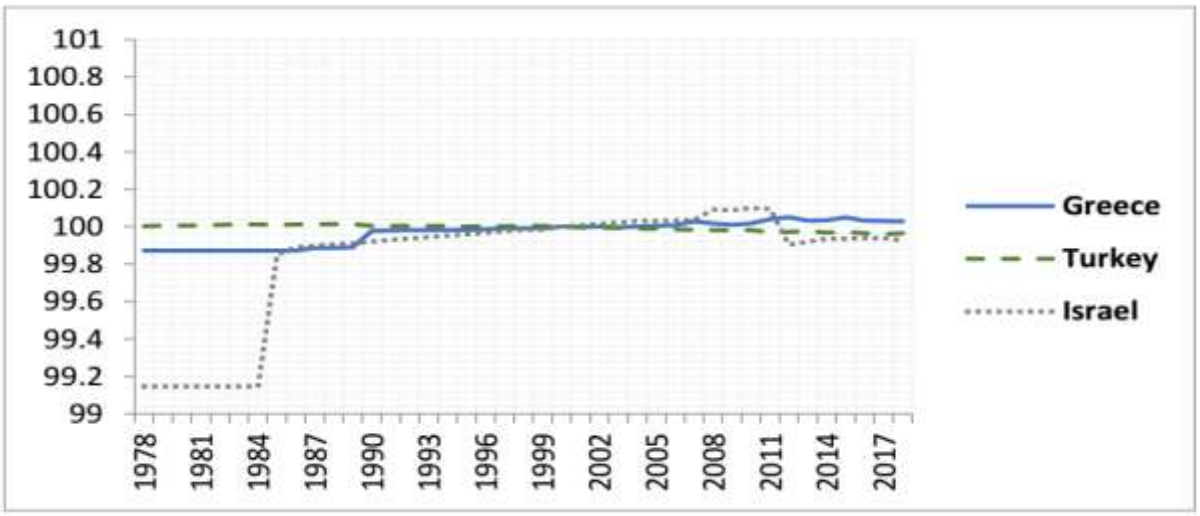

Fig. 3. Res for Greece, Turkey & Israel from 1978 to 2018.

According to Fig.3, Greece's Res consumption has increased by about 15%. For Turkey Res, consumption saw stability (1978-2018), without marked variations. A sharp increase (+94%) in Res consumption was observed in Israel from 1984 to 2009, whereas the most recent period (2009-2018) is characterized by a moderate decrease (-28%).

Fig. 4 presents the evolution of population for the three economies (1978-2018).

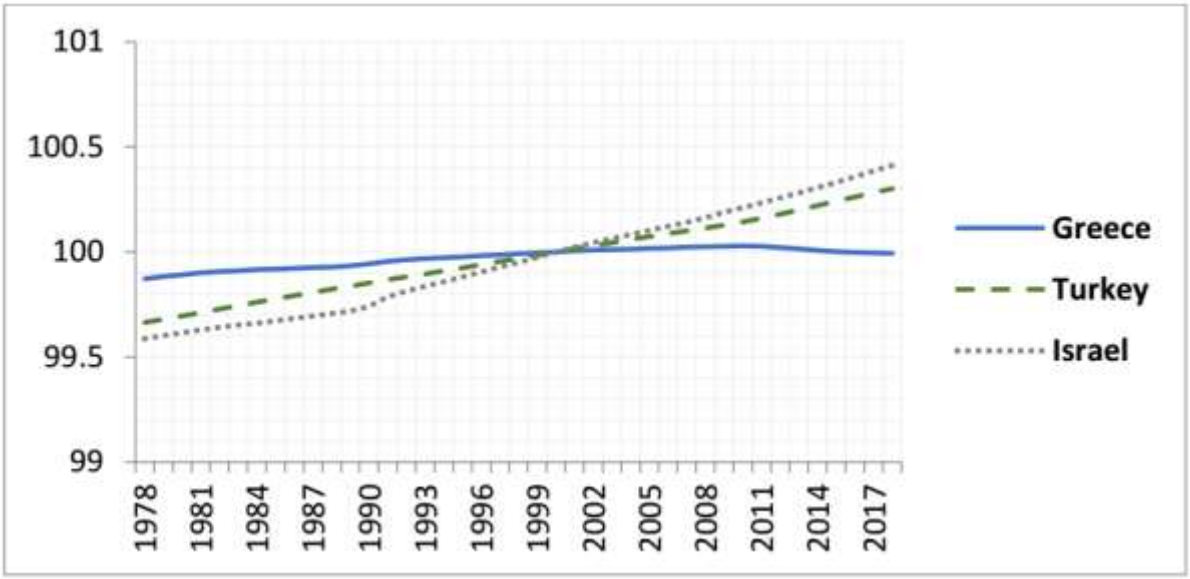

Fig. 4. Population for Greece, Turkey & Israel from 1978 to 2018,

In Fig. 4, we observe similar upward trends in the population of Turkey (+61%) and Israel (+81%) during the investigation period. In the case of Greece, a slight increase (+5%) is reported.

Fig. 5 presents the evolution of GDP for the three economies (1978-2018).

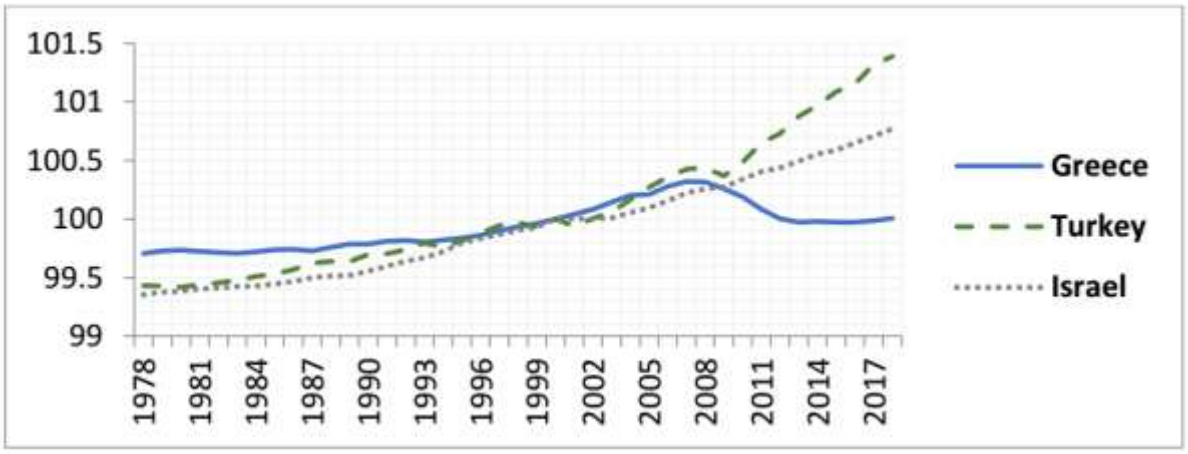

Fig. 5. GDP for Greece, Turkey & Israel from 1978 to 2018.

Greece's GDP increased significantly by 60% in the period 1978-2007. After peaking in 2007, GDP in Greece has sustained a remarkable loss of 32% from 2008 to 2018. The trajectory of Turkey's and Israel's GDP reports small fluctuations leading to an overall tremendous increase of 196% and 99% respectively.

Fig. 6 presents the evolution of Tfp for the three economies (1978-2018).

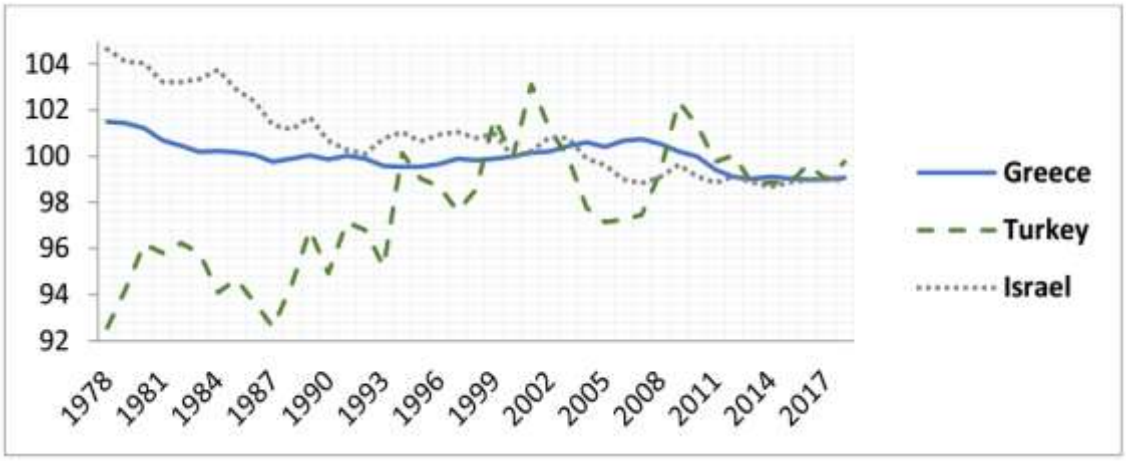

Fig. 6. Tfp for Greece, Turkey & Israel from 1978 to 2018.

Greece's Tfp demonstrates a steady evolution, resulting in an inappreciable reduction in 2018 (-2,8 %). Tfp in Turkey recorded high variations during the study period, with the index values in 2018 exceeding those of 1978 by approximately 7.2%. Finally, Fig. 6 illustrates evidence of a small decline (-5,68 %) in Israel's Tfp from 1978 to 2018.

Table 2 shows the basic Descriptive Statistics of CO_2, Rec, Inc, and Tfp for the economies of Greece, Turkey, and Israel.

Table 2. Descriptive Statistics of Tfp, GDP, Inc, Rec, and CO_2 for the Greek (a), Turkish (b), and Israeli (c) Economies.

a. ***Greece***	*CO_2*	*Rec*	*Inc*	*Tfp*
Minimum	52,580	0,650	18049,184	-0,001
Maximum	112,750	0,760	30054,889	0,304
Mean	82,477	0,703	22221,108	0,122
Std. Deviation	19,139	0,033	3606,990	0,077
b. ***Turkey***	*CO_2*	*Rec*	*Inc*	*Tfp*
Minimum	71.669	0,740	4986,364	-0,093
Maximum	397,107	0,880	15190,099	0,145
Mean	196,776	0,871	8626,808	0,027
Std. Deviation	94,270	0,044	2981,852	0,059
c. ***Israel***	*CO_2*	*Rec*	*Inc*	*Tfp*
Minimum	17,306	0,110	14460,518	-0,226
Maximum	74,210	0,734	34749,678	0,013
Mean	45,908	0,511	23881,235	-0,088
Std. Deviation	19,878	0,254	6154,950	0,059

The average CO_2 emissions were higher for Turkey (196,776), followed by Greece (82,477), with Israel ranking last (45,908). Data show a significant penetration of RES in the Turkish energy system compared to the other two economies, given that the Rec mean of

Turkey surpasses the Greek and Israeli Rec means by about 17% and 26%, respectively. In addition, Israel reports the lowest average GDP with a mean value of 25221,888 and a Std. Deviation of 5638,612. The income data series depicts the predominance of the Israeli economy related to the real per capita GDP. Although the Tfp index for all three economies fluctuates at low levels, it is noteworthy that Greece demonstrates greater performance in the mean value of Tfp

.

4. Empirical Results

4.1 Results of Spearman Correlations

In this subsection, we present (Tables 3-5) the results of Spearman correlation tests conducted for the period 1978-2018, with a significance level set at $\alpha = 0.01$.

Table 3. Spearman Correlation Tests for the Greek economy

		Tfp	***Inc***
Rec	Spearman Coefficient	-0,666**	0,530**
	p-value (2-tailed)	<,001	<,001
	N	41	41
CO_2	Spearman Coefficient	0,080	0,817**
	p-value (2-tailed)	0,621	<,001
	N	41	41

Table 4. Spearman Correlation Tests for the Turkish economy

		Tfp	***Inc***
Rec	Spearman Correlation	0,702**	-0,993**
	p-value (2-tailed)	<,001	<,001
	N	41	41
CO_2	Spearman Correlation	-0,711	0,993**
	p-value (2-tailed)	,201	,005
	N	41	41

Table 5. Spearman Correlation Tests for the Israeli economy

		Tfp	***Inc***
Rec	Spearman Correlation	0,635**	0,594**
	p-value (2-tailed)	<,001	<,001
	N	41	41
CO_2	Spearman Correlation	0,916**	0,967**
	p-value (2-tailed)	<,001	<,001
	N	41	41

** Correlation is significant at the 0.01 level.

For Greece, a moderate negative (-0,666) statistically significant correlation between Rec and Tfp is depicted, revealing a potential productivity cost associated with renewable

energy expansion. Conversely, we show a positive relationship between Rec and income. Finally, CO_2 emissions and income are positive strongly positively correlated at a 0,01 significance level, suggesting that the Greek economy was emissions-intensive from 1978 to 2018. This result could be compared to several previous articles (e.g. Hatzigeorgiou et al., 2011; Tsepi et al., 2024).

In Turkey, a significant positive correlation is observed between Rec–Tfp ($r_s = 0.702$). This result contradicts those of Mukhtarov (2024) since the author concluded that technological improvements and efficiency gains lead to a decrease in CO_2 emissions. Furthermore, an accent negative correlation is highlighted for the variable Rec-Inc, possibly reflecting that rising income levels are associated with greater reliance on fossil fuels rather than a transition to cleaner energy sources. Notably, the country's energy strategy has been predominantly dependent on imported fuels, especially oil and natural gas (Rüstemoğlu, 2024). The extremely high level of Spearman coefficient between the variables CO_2 and Inc highlighted the persistent carbon dependency of the Turkish economy. The positive impact of income on Turkey's CO_2 emissions is also evident from 1990 to 2019, as noted in a recent study by Akadiri et al. (2020).

For the case of Israel, we can deduce that Rec is positively and significantly linked to both Tfp and income, underscoring that the increase of Res consumption drives economic growth and productivity improvements. Nevertheless, the pronounced positive Spearman coefficients between CO_2–Tfp and CO_2-Inc indicate that the rise of economic output and technological progress increases emissions.

4.2 Results of Decoupling Analysis

This section attempts to interpret the link between energy consumption and economic growth using Decoupling Analysis.

Table 6. Decoupling Analysis of Energy Consumption for 1978-2018 in Greece.

Time Period	DI_{GDP}	Decoupling state
1978-1988	3,97	*Expansive decoupling*
1988-1998	1,57	*Expansive decoupling*
1998-2008	0,43	*Weak decoupling*
2008-2018	3,97	*Recessive decoupling*

Table 7. Decoupling Analysis of energy consumption for 1988-2018 in Turkey.

Time Period	DI_{GDP}	Decoupling state
1978-1988	0,90	*Expansive decoupling*
1988-1998	0,80	*Expansive decoupling*
1998-2008	0,77	*Weak decoupling*
2008-2018	-34,40	*Strong decoupling*

Table 8. Decoupling Analysis of energy consumption for 1988-2018 in Israel.

Time Period	DI_{GDP}	Decoupling state

1978-1988	1,24	*Expansive decoupling*
1988-1998	0,82	*Expansive decoupling*
1998-2008	0,75	*Weak decoupling*
2008-2018	-13,16	*Strong decoupling*

Tables 6, 7, and 8 show that the impact of the financial crisis on the decoupling state is more intensive in Greece than in Turkey and Israel. More specifically, in the decade 2008-2018, Greece's DI was 3,97. This crucial finding coincides with similar studies for the Greek economy (e.g. Obradović and Lojanica 2017; Roinioti and Koroneos, 2017); the authors confirmed the significant effect of economic recession on the decoupling progress. The decades 1978-1998 are characterized by an expansive decoupling state for all economies, indicating substantial economic growth alongside reduced energy consumption. A possible explanatory reason for this should be structural changes in the economic systems, such as a shift from energy-intensive industries to service-oriented sectors, improvements in energy efficiency, or the adoption of cleaner energy technologies. Turkey and Israel reported a strong decoupling from 2008-2018, with DI values -34,4 and -13,16 respectively, indicating that energy consumption declined during this period, even as the economy expanded.

5. Conclusions, limitations, & Future Directions

This study employs a Descriptive Statistical Analysis, Spearman Correlation tests, and a Decoupling Analysis among CO_2 emissions, energy consumption, and economic growth, for Greece, Turkey, and Israel's economies, during 1978–2018. The Eastern Mediterranean has emerged as a pivotal energy hub, with Greece, Turkey, and Israel playing critical roles in ensuring energy resilience, especially after the Russian Federation invaded Ukraine. Ensuring energy security has been the most critical goal for achieving sustainable development (Thai-Ha Le & Nguyen, 2019). In addition, the Eastern Mediterranean and Middle East regions are considered highly climate-sensitive, as they have experienced warming at approximately twice the rate of the global average temperature increase for the period between 1981 and 2019 (Zittis et al., 2022; Gialesakis et al., 2023). Thus, delineating the relationships between economy, energy, and environment offers valuable insight into the structure of these economies, which are anticipated to influence the geopolitical landscape in the coming years. Our approach attempts to incorporate the Tfp into the energy-economy nexus, an essential index for designing policies that optimize renewables' economic and environmental benefits, especially in developing economies where productivity growth is a priority.

The results of Descriptive Statistical Analysis highlight distinct sustainable development paths and energy transitions; Turkey exhibits notable progress in renewable energy penetration, Israel stands out with superior real per capita GDP, and Greece records the highest mean total factor productivity. The results of Spearman tests reveal a significant positive correlation between CO_2 emissions and income in all economies under consideration, emphasizing that economic growth is a key driver of environmental degradation. Notably, the relationship between CO_2 emissions and Total factor productivity exhibits either positive trends (Turkey and Israel) or no statistical significance (Greece). This implies that the three economies should enhance productivity and promote energy efficiency improvements to ensure a measurable reduction in carbon dioxide emissions in all economic sectors. Regarding the nexus Rec and Tfp, the reasonable argument that the increasing value of Tfp is interconnected to a growing penetration of Res has been evident in the case of Turkey and Israel. Conversely, the negative correlation between Rec-Tfp for the Greek economy may

reflect the transitional challenges and structural adjustments required for integrating these technologies in Greece (e.g. high initial investment costs and capital intensity, regulatory and institutional barriers).

As regards the Decoupling Analysis, we deduced that Turkey and Israel, although they follow different energy and environmental policies, have similar patterns in the decoupling progress. The most crucial remarks are summarized below:

a. *Greece*: Periods of expansive decoupling were observed, but weak trends in the early 2000s and recessive decoupling post-2008 underscore systemic issues. Key recommendations include enhancing energy efficiency, establishing consistent policy frameworks in Res's projects, and reforming high-emission sectors like transportation and industry (Paschalidou et al., 2022).
b. *Turkey:* Strong decoupling emerged between 2008–2018 following earlier phases of weak decoupling. Reducing CO_2 emissions—accounting for approximately 1.2% of global emissions in 2021[7]—through investments in low-carbon technologies, green industrialization, and minimizing reliance on imported fossil fuels is crucial for achieving sustainable growth. This approach also serves as a representative for other emerging economies in Asia and South Africa.
c. *Israel:* From expansive decoupling (1978–1998) to strong decoupling (2008–2018), Israel demonstrated significant progress driven by increasing penetration of cleaner technologies in energy systems, electricity market reforms, and energy independence. Policymakers should prioritize enhancing energy security by leveraging renewable energy sources for domestic electricity production (Hamed and Bressler, 2019). By encouraging strategic investments in international energy projects, Israel has the potential to emerge as a leading innovator in the energy field within the Eastern Mediterranean region.

Finally, the energy and environmental policies of Greece, Turkey, and Israel will undoubtedly affect the geopolitical competition in the Eastern Mediterranean and the Middle East in the future. In this context, research on the relationship between energy variables and their impact on environmental and economic figures should be continued. Although the present paper aims to delineate the correlations between energy consumption, renewable energy penetration, Tfp, CO_2 emissions, and income, using popular and easy-to-use techniques, it does not incorporate the causal relationships among the selected variables. So, further analysis should adopt modern econometric techniques at the national or sectoral level, focusing also on the influence of novel socioeconomic indicators (e.g., household number, household size, Gini index, energy poverty, HDI-Human Development Index, RECAI-Renewable Energy Country Attractiveness Index) on the energy and environmental systems.

6. References

Abbas, Q., HongXing, Y., Ramzan, M. et al. (2024). BRICS and the climate challenge: navigating the role of factor productivity and institutional quality in CO2 emissions. Environ Sci Pollut Res 31, 4348–4364. https://doi.org/10.1007/s11356-023-31321-x

Akadiri, S.S., Adewale, A.A., Olasehinde-Williams, G., & Etokakpan, M.U. (2020). The role of electricity consumption, globalization and economic growth in carbon dioxide emissions and its implications for environmental sustainability targets. Science of The Total Environment, 708. https://doi.org/10.1016/j.scitotenv.2019.134653

Asuero, A.G., Sayago A., & González A.G. (2006). The correlation coefficient: An overview, Critical Reviews in Analytical Chemistry, 36, 41–59. https://doi.org/10.1080/10408340500526766

[7] https://edgar.jrc.ec.europa.eu/report_2022

Barrera-Santana, J., Gustavo, A., Marrero, & Francisco J. Ramos-Real, (2022). Income, energy and the role of energy efficiency governance, Energy Economics, 108. https://doi.org/10.1016/j.eneco.2022.105882

Bithas, k., & Kalimeris, p. (2013). Re-estimating the decoupling effect: Is there an actual transition towards a less energy-intensive economy? Energy, 51, 78-84. https://doi.org/10.1016/j.energy.2012.11.033

Bozkurt, C., Akan, Y. & (2014). Economic Growth, CO_2 Emissions and Energy Consumption: The Turkish Case. International Journal of Energy Economics and Policy, 4, 484-494. https://doi.org 10.1504/IJETP.2019.098956

Dagar, V., Rao, A., Dagher, L., & Doytch, N. (2024). Climate change dynamics for global energy security and equity: Evidence from policy stringency drivers. Journal of Environmental Management, 370. https://doi.org/10.1016/j.jenvman.2024.122484

Debone, D., Leite, V.P., & Miraglia, S.G.E.K. (2021). Modelling approach for carbon emissions, energy consumption and economic growth: A systematic review. Urban Climate, 37, 100849. https://doi.org/10.1016/j.uclim.2021.100849

Dergiades, T., Martinopoulos, G., & Tsoulfidis, L. (2013). Energy consumption and economic growth: Parametric and non-parametric causality testing for the case of Greece. Energy Economics, 36, 686-697. https://doi.org/10.1016/j.eneco.2012.11.017

Diakoulaki, D., Giannakopoulos, D., & Karellas, S. (2017). The driving factors of CO_2 emissions from electricity generation in Greece: an index decomposition analysis. International Journal of Global Warming,13, 382-397. https://doi.org/10.1504/IJGW.2017.087205

Diakoulaki, D., Hontou, V., Pavlidou, S., & Mavrotas, G. (2000). Decomposition analysis of CO_2 emissions from the Greek manufacturing sector. Global Nest, 2, 119–27. https://doi.org/10.30955/gnj.000167

Dritsaki, C., & Dritsaki, M. (2014). CO_2 Emissions, Energy Consumption, Financial Development and Economic Growth: A Multivariate Cointegration and Causality Analysis for Greece. World Applied Sciences Journal, 32, 309-321. https://doi.org/10.5829/idosi.wasj.2014.32.02.808

EDGAR - Emissions Database for Global Atmospheric Research. https://edgar.jrc.ec.europa.eu/report_2022. / (accessed 13 December 2024).

Gialesakis, N., Kalivitis, N., Kouvarakis, G., Ramonet, M., Lopez, M., Kwok, C.Y., Narbaud, C., Daskalakis, N, Mermigkas, M., Mihalopoulos, N., & Kanakidou, M. A. (2023). A Twenty Year Record of Greenhouse Gases in the Eastern Mediterranean Atmosphere. Sci. Total Environ, 864. https://doi.org/10.1016/j.scitotenv.2022.161003Get rights and content

Hamed, T.A., & Bressler, L. (2019). Energy security in Israel and Jordan: The role of renewable energy sources. Renewable Energy, 135, 378-389. https://doi.org/10.1016/j.renene.2018.12.036

Hatzigeorgiou, E., Polatidis, H., & Haralambopoulos, D. (2010). Energy CO_2 emissions for 1990–2020: a decomposition analysis for EU-25 and Greece. Energy Sources A: Recov Util Environ, 32, 1908–1917. https://doi.org/10.1080/15567030902937101

Hatzigeorgiou, E., Polatidis, H., & Haralambopoulos, D. (2011). CO_2 emissions, GDP and energy intensity: A multivariate cointegration and causality analysis for Greece, 1977–2007. Applied Energy, 88,1377–1385. https://doi.org/10.1016/j.apenergy.2010.10.008

Jerzmanowski, M. (2007). Total factor productivity differences: appropriate technology vs. efficiency. Eur Econ Rev, 51, 2080–110. https://doi.org/10.1016/j.euroecorev.2006.12.005

Jiang, Z., Ding, Z., Zhang, H., Cai, W., Liu, Y. (2019). Data-driven ecological performance evaluation for remanufacturing process. Energy Convers. Manage, 198, https://doi.org/10.1016/j.enconman.2019.111844

Koilakou, E., Hatzigeorgiou, E., & Bithas, K. (2022). Carbon and energy intensity of the USA and Germany. A LMDI decomposition approach and decoupling analysis. Environmental Science and Pollution Research, 30, 1-16. https://doi.org/10.1007/s11356-022-22978-x

Koilakou, E., Hatzigeorgiou, E., Bithas, K. (2024). Social and economic driving forces of recent CO_2 emissions in three major BRICS economies. Scientific Reports 14, 8047. https://doi.org/10.1038/s41598-024-58827-9

Le, T.H., & Nguyen, C.P. (2019). Is energy security a driver for economic growth? Evidence from a global sample. Energy Policy, 129, 436-451. https://doi.org/10.1016/j.enpol.2019.02.038

Lin, B., & Raza, M.Y. (2019). Analysis of energy-related CO_2 emissions in Pakistan, Journal of Cleaner Production, 219, 981-993. https://doi.org/10.1016/j.jclepro.2019.02.112

Lv, J., Gu, F., Zhang, W., & Guo, J. (2019). Life cycle assessment and life cycle costing of sanitary ware manufacturing: A case study in China. Journal of Cleaner Production, 238. https://doi.org/10.1016/j.jclepro.2019.117938

Magazzino, C., & Schneider, N. (2020). The Causal Relationship between Primary Energy Consumption and Economic Growth in Israel: A Multivariate Approach. International Review of Environmental and Resource Economics, 14, 417-491. http://dx.doi.org/10.1561/101.00000121

Magazzino, C., Mele, M. (2025). A new machine learning algorithm to explore the CO_2 emissions-energy use-economic growth trilemma. Ann Oper Res 345, 665–683 (2025). https://doi.org/10.1007/s10479-022-04787-0

Maku, O.A., & Ikpuri, P.O. (2020). A Multivariate Analysis between Renewable Energy, Carbon Emission and Economic Growth: New Evidences from Selected Middle East and North Africa Countries. International Journal of Energy Economics and Policy, 10, 440-450. DOI:10.32479/ijeep.10074

Miller, S.M., & Upadhyay, M.P. (2000). The effects of openness, trade orientation, and human capital on total factor productivity. J Dev Econ, 63, 399–423. https://doi.org/10.1016/S0304-3878(00)00112-7

Mukhtarov, S. (2024). Do renewable energy and total factor productivity eliminate CO2 emissions in Turkey?. Environ Econ Policy Stud 26, 307–324. https://doi.org/10.1007/s10018-023-00377-x

Obradović, S., & Lojanica, N. (2017). Energy use, CO2 emissions and economic growth – causality on a sample of SEE countries. Economic Research-Ekonomska Istraživanja. Taylor & Francis Journals, 30, 511-526. https://doi.org/10.1016/j.egyr.2019.07.006

OECD - Organization for Economic Co-operation and Development, (2002). Indicators to measure decoupling of environmental pressure from economic growth. http://www.olis.oecd.org/olis/2002doc.nsf/LinkTo/sg-sd / (accessed 13 December 2024).

Omri, E., Chtourou, N., & Bazin, D. (2022). Technological, economic, institutional, and psychosocial aspects of the transition to renewable energies: A critical literature review of a multidimensional process, Renewable Energy Focus, 43. https://doi.org/10.1016/j.ref.2022.08.004

Ozdemir, A.C. (2023). Decomposition and decoupling analysis of carbon dioxide emissions in electricity generation by primary fossil fuels in Turkey. Energy, 273, 127264. https://doi.org/10.1016/j.energy.2023.127264

Paschalidou, A., Petrou, I., Fytianos, G., & Kassomenos, P. (2022). Anatomy of the atmospheric emissions from the transport sector in Greece: trends and challenges. Environmental Science and Pollution Research, 29, 34670–34684. https://doi.org/10.1007/s11356-021-18062-5

Pegkas, P. (2020). The impact of renewable and non-renewable energy consumption on economic growth: the case of Greece. International Journal of Sustainable Energy. 39:4, 380-395. https://doi.org/10.1080/14786451.2019.1700261.

Roinioti, A., & Koroneos, C. (2017). The decomposition of CO_2 emissions from energy use in Greece before and during the economic crisis and their decoupling from economic growth. Renewable and Sustainable Energy Reviews, 76, 448-459. https://doi.org/10.1016/j.rser.2017.03.026

Rüstemoğlu, H. (2024). Dynamics of total and industrial energy use in Turkiye from 1991 to 2019: a case study. Environ Dev Sustain. https://doi.org/10.1007/s10668-024-05135-x

Sadorsky. P. (2021). Wind energy for sustainable development: Driving factors and future Outlook. Journal of Cleaner Production, 289, 125779. https://doi.org/10.1016/j.jclepro.2020.125779

Sharif, A., Baris-Tuzemen, O., Uzuner, G., Ozturk, I., & Sinha, A. (2020). Revisiting the role of renewable and non-renewable energy consumption on Turkey's ecological footprint: Evidence from Quantile ARDL approach. Sustainable Cities and Society, 57. https://doi.org/10.1016/j.scs.2020.102138

Tian, R., Hoy Z.X., Woon K.S., Hanafiah M.M., & Liew P.Y. (2022). Socioeconomic Correlation Analysis of E-waste and Prediction of E-waste Generation via Back-propagation Neural Network, Chemical Engineering Transactions. 97, 397–402. https://doi.org/10.1016/j.jclepro.2023.138076

Tsepi, E., Sebos, I., & Kyriakopoulos, G.L. (2024). Decomposition Analysis of CO_2 Emissions in Greece from 1996 to 2020. Strategic Planning for Energy and the Environment, 43. https://doi.org/10.13052/spee1048-5236.4332

Tugcu, C.T., & Tiwari, A.K. (2016). Does renewable and/or non-renewable energy consumption matter for total factor productivity (TFP) growth? Evidence from the BRICS. Renewable and Sustainable Energy Reviews, 65, 610-616. https://doi.org/10.1016/j.rser.2016.07.016

U.S. Security and Exchanges Commission. Available at: https://edgar.jrc.ec.europa.eu/report_2022/ (accessed 13 December 2024).

UNEP. (2011). Decoupling natural resource use and environmental impacts from economic growth, A Report of the Working Group on Decoupling to the International Resource Panel. Fischer-Kowalski, M., Swilling, M., von Weizsδcker, E.U., Ren, Y., Moriguchi, Y., Crane, W., Krausmann, F., Eisenmenger, N., Giljum, S., Hennicke, P., Romero Lankao, P., Siriban Manalang, A., Sewerin, S. http:// www.unep.org/esourcepanel/decoupling/files/pdf/Decoupling_Report_English.pdf.

University of Groningen and University of California, Davis, Total Factor Productivity at Constant National Prices, retrieved from FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/RTFPNAGRA632NRUG / (accessed 13 December 2024).

Wang, F., Zhang, Z. (2022). Decoupling economic growth from energy consumption in top five energy consumer economies: A technological and urbanization perspective, Journal of Cleaner Production, 357,131890. https://doi.org/10.3390/buildings12101745

Wang, Q, & Su, M. (2020). Drivers of decoupling economic growth from carbon emission–an empirical analysis of 192 countries using the decoupling model and decomposition method. Environ. Impact. Assess. Rev., 81, 106356. https://doi.org/10.1016/j.eiar.2019.106356

Wang, Q., & Wang, S. (2020). Is energy transition promoting the decoupling economic growth from emission growth? Evidence from the 186 countries. Journal of Cleaner Production, 260, 120768. https://doi.org/10.1016/j.jclepro.2020.120768Get rights and content.

Wiedenhofer, D., Virág, D., Kalt, G., Plank, B., Streeck, J., Pichler, M., Mayer, A., Krausmann, F., Brockway, P. & Schaffartzik, A. (2020). A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part I: bibliometric and conceptual mapping. Environ. Res. Lett., 15, 063002. https://dx.doi.org/10.1088/1748-9326/ab842a

Wu, Y., Zhu, Q., & Zhu, B. (2018). Comparisons of decoupling trends of global economic growth and energy consumption between developed and developing countries. Energy Policy, 116. https://doi.org/10.1016/j.enpol.2018.01.047

Zhang, X., Zhao, X., Jiang, Z., & Shao, S. (2017). How to achieve the 2030 CO_2 emission reduction targets for China's industrial sector: Retrospective decomposition and prospective trajectories. Glob. Environ. Chang., 44, 83–97. https://doi.org/10.1016/j.gloenvcha.2017.03.003

Zittis, G., Almazroui, M., Alpert, P., Ciais, P., Cramer, W., Dahdal, Y., & Fnais, M. (2022). Climate Change and Weather Extremes in the Eastern Mediterranean and Middle East. Rev. Geophys, 60. https://doi.org/10.1029/2021RG000762

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Authors' Contributions

The corresponding author conceptualized and designed the study, performed the data collection and analysis, and interpreted the results. He also wrote and revised the manuscript.

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Not applicable. This study does not involve human participants, animals, or sensitive data.

Consent to Participate

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The datasets of the current study are available from the corresponding author upon reasonable request.

The collective form of resilience: How cooperatives responded to the COVID-19 crisis in Hungary[1]

Abstract:
Given that cooperatives operate according to values that extend beyond market-based economic interests, this paper examines their responses to the COVID-19 pandemic, their adaptation processes, and their relationships with members. It argues that cooperatives, as people-centred organizations, respond to the needs of their communities through their specific organizational models and therefore remain resilient in times of crisis. Drawing on the experiences of cooperatives that navigated the pandemic, the analysis highlights how participatory decision-making, long-term governance orientations, and solidarity-based networks strengthen organizational resilience. The paper concludes by demonstrating how two cooperative organizations—Gólya and Cargonomia, based in Budapest, Hungary—adapted to new conditions despite being affected by the pandemic in both economic and social dimensions.

Keywords: COVID-19, New Cooperatives, Entrepreneurial Resilience, Participative Governance, Solidarity Economy

Elif Tugba Simsek[2]

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[2] Corresponding-Address: Elif Tugba Simsek, PhD, Department of Sociology, Eötvös Lorand University, Hungary. Email: eliftugbasimsek@gmail.com

1. Introduction

Emerging and re-emerging viral infectious diseases have been occurring with increasing frequency worldwide. Human factors, including population growth, urbanization, international travel, the globalization of commerce, wildlife trade, and practices such as hunting and pasturage that heighten direct exposure to animals' bodily fluids, are widely regarded as major drivers of this trend (Ka-Wai Hui, 2006). The outbreak of the novel coronavirus (COVID-19) is a prominent example (WHO, 2020). As the pandemic unfolded, societies faced not only an unprecedented global health shock but also severe economic disruption. The mandatory shutdown of non-essential businesses left large numbers of people unemployed and resulted in significant income losses for workers (ILO, 2020a, 2020b).

Cooperatives and their members were not exempt from these disruptions, and reports from Cooperatives Europe (2020) indicate that cooperatives across the continent experienced significant impacts on their activities, turnover, and workforce, regardless of size. Nevertheless, a growing body of research highlights that cooperatives tend to demonstrate greater resilience in times of crisis compared with other business forms (e.g., Roelants et al., 2012; Birchall, 2013; Narvaiza et al., 2017). More recent studies further support this view. For example, Mangan and Ward (2023) propose a heuristic model of collective action that illustrates how collective decision-making and member control help sustain resilience. Indeed, cooperatives are not merely market-oriented enterprises; by their very nature, they prioritize the well-being of their communities. This, in turn, raises important questions about how cooperatives responded to the crisis and how they sustained their relationships with members.

This paper argues that cooperatives, as people-centred organizations, adapt to community needs through their distinctive internal structures and therefore retain a degree of resilience during periods of crisis. Such resilience is rooted primarily in participatory governance, long-term approaches to management, and solidarity-based networks (Birchall & Ketilson, 2009; Roelants et al., 2012; Saner, Yiu & Filadoro, 2012; Smith & Rothbaum, 2013; Smith, 2014). Accordingly, the study asks: Through what concrete practices do cooperatives mobilize these principles during crises? How do such practices shape their resilience? And how are these dynamics manifested in cooperative responses to the COVID-19 pandemic?

The paper first explores cooperative resilience in times of crisis, drawing on existing literature, and presents several emerging examples of cooperative resilience during the pandemic from different parts of the world. Subsequently, the experiences of two Budapest-based cooperative organizations are explored: Gólya, a cooperative bar and community space, and Cargonomia, an open collective operating in accordance with cooperative principles. The research is based on semi-structured interviews with members of both organizations, as well as information gathered from their official websites, email correspondence, and academic and grey literature.

Through this analysis, the study contributes to understanding the collective dimensions of resilience in the face of adversity and may assist practitioners in identifying strategies to respond effectively to the COVID-19 crisis.

2. The Resilience of Cooperatives in Times of Crises

2.1 Cooperative Resilience

The concept of resilience has been applied across a wide range of fields—including education, sociology, psychology, medicine, ecology, management, and entrepreneurship (Korber & McNaughton, 2017; Franco, Haase & António, 2020). Its interdisciplinary nature has resulted in multiple definitions and measurement approaches within each discipline (Myers & Smith, 2012; Angeler & Allen, 2016;

Kativhu, Mwale & Francis, 2018; Franco, Haase & António, 2020). Since 2008, however, resilience has attracted increasing attention within entrepreneurship research (Korber & McNaughton, 2017), a trend closely linked to the aftermath of the global economic crisis. Entrepreneurs, indeed, frequently face contingencies that threaten business survival, such as financial instability, technological disruption, and market competition (Franco, Haase & António, 2020). In this context, resilience is viewed as a capacity that enables enterprises to respond to and withstand such challenges. It is commonly understood as the ability of entrepreneurial individuals or organizations to overcome difficulties through adaptability, capabilities, and the cultural environment in which they operate (Manzana & Ayala, 2013).

Much of this existing literature addresses entrepreneurial resilience only indirectly, associating it with concepts such as success, survival, or persistence. However, as Korber and McNaughton (2017) suggest, resilience should encompass more than preparedness or coping capacity; it should be conceptualized as a dynamic process of positive transformation under adverse conditions. This approach shifts attention away from resilience as a simple predictor of entrepreneurial success and toward the role of resilient entrepreneurship in enabling long-term sustainability. Indeed, the concept of "resilience" itself does not guarantee universally positive outcomes. Entrepreneurial decisions may foster short-term economic survival while undermining longer-term socio-economic stability if broader social dynamics are overlooked (Korber & McNaughton, 2017). In a similar vein, Aldrich and Martinez (2001) argue that understanding entrepreneurial outcomes requires a process-, context-, and outcome-oriented perspective. Such an approach moves the focus from individual traits to the consequences of entrepreneurial actions and embeds resilience within a wider social and environmental context.

This broader perspective is also essential for understanding collective forms of resilience, such as cooperatives. Resilience should not be reduced to individual capacities alone. Cooperatives, in particular, have gained recognition for their resilience during global economic and employment crises, a strength often attributed to their democratic and participatory governance models (Birchall & Ketilson, 2009; Cooperatives Europe, 2012; Saner, Yiu & Filadoro, 2012; Smith & Rothbaum, 2013; Smith, 2014). Recent scholarships also reinforce this. Billiet et al., (2021) show that cooperatives' governance features, especially member centrality, their deep embeddedness in local communities and global movements contributed significantly to their resilience during the COVID-19 crisis. This approach not only makes cooperatives individually resilient but also contributes to broader social and environmental resilience.

Given this evidence, this paper adopts the assumption that collective forms of resilience in cooperatives are a critical component of entrepreneurial resilience. These practices, rooted in cooperative governance and member engagement, support not only short-term crisis recovery but long-term socio-economic sustainability. Cooperatives promote sustainable development in their communities through policies decided by their members (ICA, 2018a), grounded in values like honesty, openness, social responsibility, and care for others (ICA, 2018a). These values reinforce cooperatives as vehicles for economic, social, and environmental sustainability (ICA, 2013).

Cooperatives, indeed, frequently adapt or emerge in response to challenges, leveraging their collective structure and governance to mitigate adverse effects (Parnell, 2001). Worker cooperatives, for example, often share burdens collectively, implementing measures such as voluntary pay cuts or exploring new markets to preserve jobs, rather than resorting to mass layoffs typical of conventional firms (Kelly, 2020). These practices illustrate how participatory and collective governance strengthen resilience (Birchall & Ketilson, 2009; Roelants et al., 2012; Saner, Yiu & Filadoro,

2012; Smith & Rothbaum, 2013; ICA, 2013; Smith, 2014).

Resilience is further reinforced by long-term strategies focused on community well-being and by solidarity networks that provide alternative economic and social resources, helping cooperatives remain less vulnerable to market fluctuations (Saner, Yiu & Filadoro, 2012; Cooperatives Europe, 2012; ICA, 2013). In this paper, these features are considered interconnected aspects of collective resilience, which collectively shape how cooperatives respond to crises and support long-term socio-economic sustainability.

2.2 Cooperative Responses to the COVID-19 Crisis

COVID-19, caused by a newly discovered coronavirus, was first identified in December 2019 and quickly escalated into a global pandemic (WHO, 2021). By mid-2021, approximately 190 million confirmed cases had been reported (WHO COVID-19 Dashboard, June 2021). The pandemic has not only represented a public health crisis but also a profound economic shock: job losses and reduced working hours led to the equivalent of 255 million lost jobs worldwide in 2020 (UN News, 2021), while global GDP growth in 2021 was projected at 5.4 percent—about 6½ percentage points lower than pre-pandemic forecasts (World Economic Outlook, 2020). Vulnerable populations, including those already living in poverty, marginalized groups, and women, were disproportionately affected, experiencing greater economic hardship and limited access to health and social services (Dave, 2021; UN, 2020).

In this context, cooperatives and their communities were inevitably affected, both economically and socially. While responses to economic crises have been well documented, the COVID-19 pandemic represents a distinct type of threat—more gradual than sudden natural disasters but disruptive to both social interactions and core cooperative operations. Cooperatives, indeed, driven by values of solidarity, equality, and social justice (ICA, 2018b), faced the dual challenge of maintaining their community-oriented missions while adapting to restrictions that limited physical and social interactions (ICA, 2020).

Emerging evidence from around the world highlights the adaptability and resilience of cooperatives during COVID-19. ICA (2020) reports that large retail cooperatives such as S-Group and Midcounties Co-operative adapted their business models to new safety requirements, supported vulnerable members and customers. They developed services such as foodbank funds and introduced new concepts of home delivery and take-away options, all while maintaining a solidarity- and member-centered approach. Worker and social cooperatives also demonstrated resilience in protecting their members and in responding to the needs of society at the local level (CICOPA, 2020). For example, the SEWA Cooperative Federation provided food, health kits, and cash transfers to members, while Italian cooperatives affiliated with Legacoop produced 400,000 washable masks for essential workers, funded by Coopfond. Similarly, in the United States, Community Printers, a 33-member worker cooperative, avoided layoffs by restructuring operations and furloughing half of the staff voluntarily, while continuing to provide benefits, demonstrating how participatory decision-making and solidarity underpin cooperative resilience (Newport, 2020).

These cases illustrate that, despite widespread economic disruption, many cooperatives maintained operations, supported their members, and adapted to new conditions through solidarity, member-centred decision-making, and long-term, community-oriented strategies. In the following section, the study explores cooperative responses to the COVID-19 crisis in Hungary, examining two concrete case studies to understand how these principles operate in practice.

3. Empirical Setting — Hungary in a Nutshell

The cooperative movement in Hungary has a long history, reaching back to the nineteenth century. Its development is commonly divided into three distinct periods: the era prior to World War II, beginning with the Act on Commerce (37/1875), which first introduced cooperatives into Hungarian law (Kiss & Mihály, 2019); the period following World War II; and the period after the regime change in 1989, which marked Hungary's transition from a state-socialist system to a market-based political and economic order (Cracogna, Fici & Henrÿ, 2013: 431–432).

In the first period, Hungarian legislation was grounded in the principles and practices of Rochdale[3], aligning closely with European legal frameworks of the time (Cracogna, Fici & Henrÿ, 2013: 447). Following World War II, the operation of cooperatives underwent significant transformation under state-socialist policies (Kiss & Mihály, 2019). During this period, many cooperatives were reorganized into centrally coordinated structures designed to meet broader social and economic planning goals. While these arrangements limited autonomous, member-driven control, cooperatives also played an important role in rural development, employment provision, and ensuring broad access to essential goods and services.

After the regime change in 1989, the number of cooperatives declined sharply. Many existing cooperatives were converted into for-profit companies, while others ceased to operate altogether (G. Fekete et al., 2017). These developments gained rapid social and political approval, as cooperatives came to be viewed as remnants of the previous socialist system (Gagyi, 2019; Kiss & Mihály, 2019). In line with global economic trends, the introduction of neoliberal policies further reinforced a shift away from community-based economic models (Kiss & Mihály, 2019).

On the other hand, the 2008 economic crisis generated renewed interest worldwide in alternative, community-oriented initiatives capable of addressing market failures (Vieta & Lionais, 2015). Other analyses suggest that this trend has continued, particularly in light of growing concerns about economic inequality, social vulnerability, and the climate crisis (e.g., ILO, 2016). Cooperatives re-emerged as potential solutions due to their participatory and democratic structures (Birchall & Ketilson, 2009; Birchall, 2013). Parallel to this global trend, a proliferation of new cooperative organizations also appeared in Hungary (see Ádám & Czerván, 2020), even though the development of a robust cooperative movement received limited support in the post-socialist era.

Thus, two of these newer cooperative initiatives in Hungary—Gólya and Cargonomia—serve as the case studies for this paper and will be examined in terms of their responses to the COVID-19 crisis.

3. Research Cooperatives

The first case, Gólya, is a cooperative whose origins date back to 2011, when its founding group operated a community café in Budapest. After reorganizing, the cooperative Gólya was formed and relocated to a new venue in 2013. However, increasing space constraints and neighborhood gentrification led to another move. Following an intensive, largely self-managed renovation process, Gólya reopened in 2019 at its current location on Orczy Road, Budapest where it became part of a broader collaborative project, Kazán Közösségi Ház, together with allied organizations (Gólya, n.d).

[3] The original Rochdale Principles were officially adopted by the International Co-operative Alliance (ICA) in 1937 as the Rochdale Principles of Co-operation: voluntary and open membership, democratic member control, member economic participation, autonomy and independence, education, training, and information, cooperation among cooperatives, https://www.ica.coop/en/cooperatives/cooperative-identit

Gólya has progressively diversified its activities beyond hospitality. During the COVID-19 lockdowns, members launched two new branches based on skills developed during the cooperative's relocation and their commitment to low-carbon mobility: Gólya Építők, a community-oriented renovation collective, and Gólya Futárszolgálat, a cargo-bike courier service. Today, the cooperative operates across three main areas—hospitality, bicycle delivery, and construction—under a shared mission of strengthening solidarity-based, community-embedded economic practices (Gólya, n.d.).

The second case, Cargonomia, was founded in 2015—although, as a group of friends, its roots go back further—as the formalization of a long-standing collaboration between three socially and environmentally committed enterprises: Cyclonomia (a DIY bicycle cooperative), Zsámboki Biokert (an organic farm and education center), and Kantaa (a self-organized bike messenger service) (Cargonomia, n.d.). Cargonomia functions as a hub that integrates these partners' complementary activities, sustainable food production, low-carbon mobility, and bicycle advocacy, to strengthen community access to locally produced, environmentally responsible goods. Deliveries are carried out with locally manufactured cargo bikes, reinforcing the cooperative's ecological orientation. Beyond logistics, Cargonomia hosts workshops, community events, and degrowth-oriented educational programs that promote self-sufficiency and sustainable urban transitions (Cargonomia, n.d.).

Table I. Two Cooperative Cases

Name	Location	Activities	Organization	Members
Gólya	Budapest	Hospitality Construction Bike courier Community projects	Cooperative	16
Cargonomia	Budapest	Cargo bike sharing Organic farming Urban agroforestry Education-Research	Open collective	6 core members*

***** The number of core members refers to members who attend the activities and decision-making process of Cargonomia regularly. Apart from the core members, Cargonomia has volunteers and three partner organizations: Cyclonomia, Zsamboki Biokert, Kantaa.

While Cargonomia is an open collective run by cooperative principles with its volunteers, partners and six core members, Gólya is officially a cooperative with its 16 members, several candidate members, and volunteers. Together, Gólya and Cargonomia represent two new, socially oriented cooperative initiatives in Hungary that align with broader global trends in cooperative resurgence and resilience, making them well suited for analyzing cooperative responses to the COVID-19 crisis.

4. Methods

This study employs a qualitative case study design to investigate how two Hungarian cooperatives—Gólya and Cargonomia—responded to the COVID-19 crisis. The analysis draws on multiple data sources, including publicly available materials about cooperatives and semi-structured interviews with cooperative members. This approach enables a nuanced understanding of the cooperatives' organizational structures, practices, and crisis responses.

Thus, data collection proceeded in three stages. First, relevant secondary materials were gathered, including information published on the cooperatives' official websites, prior academic and grey literature, media reports, and newsletters. These documents provided contextual background on each cooperative's history, mission, and organizational model.

Second, in-depth semi-structured interviews were conducted with members of both cooperatives to generate primary empirical evidence. The interviews were conducted between November 2020 and April 2021, during the height of the COVID-19 pandemic, enabling real-time insights into cooperative responses. Eight interviews were carried out in Budapest—four with members of Gólya and four with members of Cargonomia. Interviews focused on governance practices, internal decision-making, relationships with members and partners, and perceived challenges and adaptations during the COVID-19 pandemic. When clarification or additional details were required, follow-up questions were addressed through email exchanges, which are cited in the text as *personal communication*.

Third, data analysis involved a two-step interpretive process. Initially, the organizational structures of Gólya and Cargonomia were examined to identify whether and how the commonly discussed features of cooperative resilience, such as participatory governance, long-term orientation, and solidarity networks, were represented in their discussions and reflected in their daily operations (Figure 1. Online representations of the organizational approaches of the research cooperatives). Subsequently, interview transcripts were analyzed thematically to explore how these cooperatives operate, and how they experienced and responded to the pandemic. This combined approach allows contextually grounded examination of cooperative resilience in practice, shedding light on how participative and community-based organizational forms navigate unprecedented disruptions.

Although the research does not involve sensitive personal data, the identities of interview participants have been anonymized for confidentiality. Interviewees are cited anonymously (e.g., "Gólya member 1, 2, 3..."), and all identifying details have been omitted. Interview excerpts were lightly edited for clarity and readability, while preserving their original meaning.

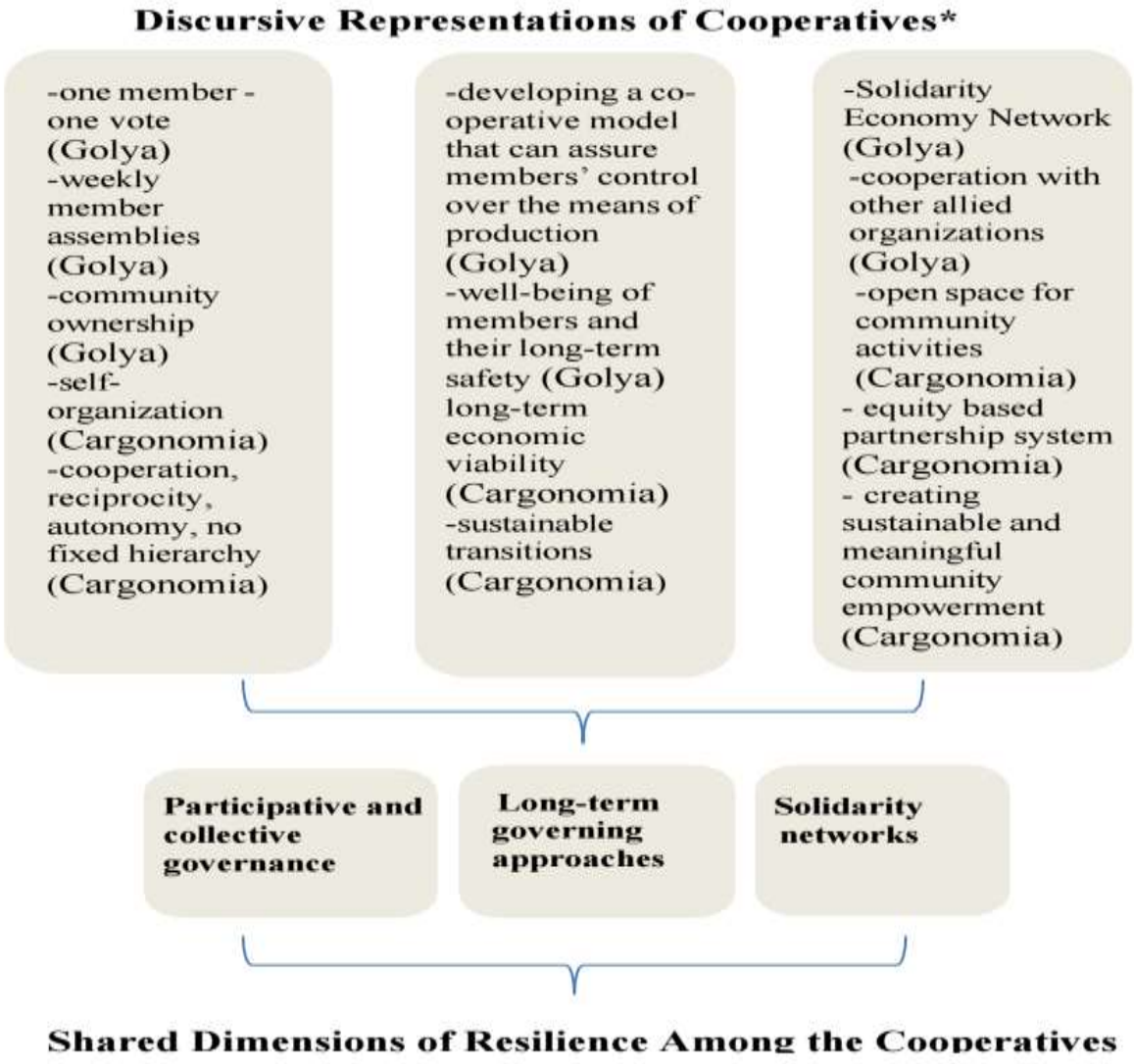
5. The Resilience of Cooperatives: Participative, Long-Term, and Solidarity-Based Approaches

An examination of the official websites and media coverage of Gólya and Cargonomia reveals several shared organizational characteristics that align with the three common dimensions of cooperative resilience identified in the literature—participative and collective governance, long-term orientation, and solidarity networks. Figure 1 illustrates how these characteristics are represented discursively across both cooperatives.

The online representations of Gólya and Cargonomia emphasise three mutually reinforcing dimensions of resilience: participativ governance, long-term governance approaches, and solidarity networks, despite apparent operational differences between the two cases. For example, Cargonomia defines itself as an open collective and deliberately avoids formal legal registration (Participant from Cargonomia, personal communication, 22 May 2021), whereas Gólya identifies as a legally established cooperative (Gólya, n.d.). Yet both initiatives articulate governance as participatory and non-hierarchical in their unique ways—whether through Gólya's formal one-member-

one-vote system and regular member assemblies or Cargonomia's cooperative ethos grounded in reciprocity, autonomy, and flexible self-organization. Their long-term approaches similarly highlight commitments to members' well-being, community empowerment, and sustainable socio-economic transitions, demonstrating how future-oriented planning is embedded into everyday operations. Finally, both cooperatives situate themselves within broader solidarity networks, ranging from Gólya's integration into the Solidarity Economy Network (SEN)[4] to Cargonomia's equity-based partnerships with other communities and projects, underscoring their intention to remain economically viable through embeddedness in supportive alliances.

Figure 1. Online representations of the organizational approaches of the research cooperatives



*Discourses were derived from the official websites of Gólya and Cargonomia, as well as media coverage from Cooperative City, RIPESS Europe, Kafka Desk, and Kulturanova

Building on the discursive representations discussed above, the interview data further illuminate how the internal practices of Gólya and Cargonomia enact the three resilience dimensions—participative governance, long-term orientation, and solidarity

[4] The SEN aims to build a solidarity economy in Hungary by strengthening solidarity among various alternative economic initiatives and cooperatives, and by creating new ones (Participant from Golya, personal communication, 30 Nov 2023).

networks—in everyday organizational life. For instance, members of both organizations emphasized that inclusive decision-making is central to their sense of belonging and organizational purpose. As one Gólya member explained: *Each member has one vote, regardless of the percentage of shares they own. However, decision-making is consensus-based and often results in a compromise between different suggestions or opinions. Members also have the right to veto a decision* (Gólya member 1). Another member of Gólya shared their thoughts on being a decision-maker at work: *Here in Gólya, I feel I am more beneficial and actively involved in the decision-making process. Every member of Gólya must know the cooperative's social mission and financial matters. I prefer to be a decision-maker in my workplace* (Gólya member 2).

A participant from Cargonomia similarly highlighted how collaboration and strong interpersonal ties sustain engagement: "*Working together, not just as colleagues but as friends, has a big impact. When you deal with a lot of things, as in our case, collaboration makes things easier*" (Cargonomia member 1)." The same member further reflected, *our project design is a more free-flowing, fluid, changing process. It sometimes could resemble chaos, but this is controlled chaos. A working environment where people can jump in and jump out and bring their own energy and projects when they have time* (Cargonomia member 1).

Participative and collaborative aspects are indeed essential components of cooperative governance. As Hale and Carolan (2018) caution, cooperatives can risk becoming "uncooperative" when participatory mechanisms are weak or exclusionary. For several members of Gólya and Cargonomia, participatory and collective governance was not only a procedural issue but also a meaningful alternative to hierarchical employment, even though the two cooperatives differ in their organisational structures. One Gólya participant contrasted cooperative work with his previous experiences in the private sector: *I worked in a company for three years. I didn't feel like I was working for myself but only for the company's profit. You can be free in Gólya, but at the same time, you can work for the benefit of society. Also, there is no boss. I can join the decision-making process* (Gólya member 2). Likewise, Cargonomia members stressed the importance of non-hierarchical relations regarding their work: *There's no fixed hierarchy and official team planning meetings are only scheduled when they deem them necessary. It's a volunteer-based structure…* (Kafkadesk, n.d., par.5).

The interviews also underscore how long-term orientation is embedded in the cooperatives' governance. Long-term orientation is widely recognized as an essential dimension of cooperative resilience. Rather than pursuing short-term gains, cooperatives often adopt strategies grounded in continuity, ethical commitments, and community development (Vieta & Lionais, 2015; Novkovic & Webb, 2020; Birchall, 2021). Dash (2014) situates this disposition historically, arguing that humans have evolved complex ethical systems and norms that enable long-range, collective thinking despite immediate rational incentives. From this perspective, long-term commitment is not only a governance preference but a deeply embedded social capacity—one that allows communities to act for durable, shared benefit.

For Cargonomia, the long-term ethos is expressed through its explicit engagement with degrowth theory, a paradigm that, in a broad sense, criticized endless economic expansion and instead promotes intentional, democratic downscaling of production and consumption (Degrowth, 2020). Degrowth, however, extends beyond being merely an economic concept; it invites exploration of new imaginaries that are liberated from economism and emphasizes what truly matters, such as 'conviviality' and 'autonomy' (Nelson and Liegey, 2025). This broader orientation strongly resonates with how members themselves articulate the cooperative's purpose. As one member explained, the economic logic of the dominant system tend to impose a particular organizational

form, often at the expense of social and environmental values. Reflecting on this tension, they noted:

"Capitalism and its economic logic have a strong impact on the shape an organisation would take. To survive, you need to be economically competitive, whatever the social, environmental or convivial quality of life price. Hence, you need to specialise in a few skills, find a niche or make economies of scale, so step by step you are alienated by the system and have to abandon all your principles. That's why with Cargonomia and, more generally, in Degrowth, we first question the system and the heteronomy it creates" (Cargonomia member 2).

Here, resilience is understood not as adaptation within existing economic constraints but as the capacity to resist and reconfigure those constraints altogether. Another member further emphasized the importance of bridging transformative ideas with everyday practice, an effort that Cargonomia sees as essential to sustaining its long-term orientation:

"We have a unique mix of people interested in the critical analysis of classical economics, such as degrowth theory. Even though a growing number of people are taking degrowth theory as a transitional theory and as a research field, they do not know how to engage with the movement's practical side, which is unfortunate. We try to keep activities for each side. So that is unique to me." (Cargonomia member 1).

While this approach requires long-term dedication to achieving degrowth goals, such as conviviality and autonomy, it also necessitates organizational-level adjustments to align with long-term visions and strategic decisions. In this sense, the dual commitment of Cargonomia—to theoretical reflection and practical experimentation—demonstrates how cooperatives can incorporate long-term transition into their organizational routines, This interplay between theory and practice forms an important component of Cargonomia's resilience: the cooperative not only critiques dominant economic models but actively cultivates organisational forms and everyday practices that prefigure the alternatives it envisions. One example of these practices, as another Cargonomia member reflected, *in Cargonomia, we consciously or explicitly try to avoid depending on money. So we try to organize everything through an alternative route, such as a gift economy or reciprocity* (Cargonomia member 3).

Resilience in cooperatives also depends on the strength of their solidarity networks; this might manifest in various ways, as trust and solidarity among their members, local communities, and other cooperatives (Billiet, et al. 2021). Gólya, for instance, participate in the SEN and Solidarity Economy Center (SEC), a network of organizations committed to social solidarity economy principles. Membership in this network enables long-term resource pooling, knowledge exchange, and coordinated action, which are all crucial for surviving economic and ecological shocks.

A member of Gólya explained the concrete value of this network:

"The SEC is a kind of network and also a kind of research group; they hold conferences and so on. This center also supports the member organizations to cooperate with each other. And as a research group, they have much more knowledge of tenders and international platforms we can collaborate with. They support the members of this network to get involved in a project and find alternative income sources" (Gólya member 3).

Solidarity-based practices are particularly essential when cooperatives face crises or operate in hostile political-economic environments (Miner, 2023). Networks, such as SEN and SEC, function as mutual-help infrastructures, enhancing organizational stability and resilience by connecting cooperatives to alternative income streams, shared knowledge, and collaborative opportunities. Members of Cargonomia also described a range of non-monetary, reciprocity-based exchanges—from shared spaces and resources to joint food distribution and cargo-bike use. One such practice occured when Cargonomia had to relocate from their previous community space in November 2020, and they were temporarily hosted by Gólya. During this time, members of Gólya were also able to benefit from Cargonomia's cargo bikes. A member of Cargonomia reflected on this:

*"*We have temporary housing in Gólya. You can also see that as an extension of our existing collaboration with Gólya in organizing events for years. Gólya started to focus on bike messenger activities because of Covid-19. They are using bikes from our community cargo bike-sharing system. One of the box distribution points for the farm's weekly organic food box distribution system, was hosted in our former space, including all of the bicycle home deliveries, and these activities have shifted to Gólya" (Cargonomia member 1).

These examples transform participative governance, long-term orientation, and solidarity networks from abstract principles into concrete practices, such as shared spaces, reciprocal exchanges, knowledge sharing, and collaborative decision-making. These practices reinforce each other. Long-term commitments (e.g., degrowth, social justice missions) encourage the cultivation of solidarity networks, while those networks, in turn, make long-term strategies materially possible. The following section will further illustrate how these practices were evident during the COVID-19 pandemic.

6. Cooperative Reactions to the Pandemic

The interview material confirms the earlier findings that participatory governance, long-term orientations, and solidarity networks significantly reinforce the resilience capacities of cooperatives during challenging times. Cooperatives' democratic structures, for instance, enable more flexible crisis responses because they allow members to collectively redefine priorities and redistribute resources (Birchall, 2011; Billiet et al., 2021). The following Gólya excerpt exemplifies how solidarity-based decision-making buffered the impact of the pandemic, particularly during the most financially challenging phases:

"In the first wave of the coronavirus pandemic, most members had savings at home. For example, I didn't ask for a salary for a month because I had some savings at home. But the second round was much harder, as nobody had any savings left. Still, it is not the same as with other companies. Because we distribute money in solidarity and in a social way. Those with children, for example, get much more than childless members" (Gólya member 4).

This form of internal redistribution, grounded in member-centered governance, illustrates a buffering effect in which members' needs—and not only market logics—shape resource allocation. Yet flexibility also brought challenges, as noted by the same Gólya member, who emphasized the difficulties of reallocating labor during successive pandemic waves:

"We knew that the second wave of the pandemic would arrive in September or October. Many of the bar workers in our cooperative joined other blocks[5], resulting in

[5] "Block" refers to other economic activities, such as renovation and cargo-bike courier services, which Gólya initiated and engaged in during the pandemic period.

fewer people working at the bar. But this transition is not easy for everyone. For instance, jobs like bike messenger or construction work require physical ability, and not everyone can do these roles. But there are also advantages to working in a cooperative during these challenging times. Instead of facing unemployment, we have jobs here, even if the pay isn't always at full salary; at least we are earning something. Gólya is much safer in corona times than other companies" (Gólya member 4).

Such adaptations illustrate how cooperatives treat members as collaborators with needs and capacities rather than interchangeable labor. Gólya's expansion into additional work fields during the lockdowns (e.g., bike messaging and construction/renovation) and its recruitment of new members further demonstrate organizational repositioning through long-term, community-oriented planning, even amidst acute crisis. Gólya, indeed, started posting announcements on Facebook (Facebook post 19 April 2021 22.31 pm) to recruit new workers (member candidates), just as the third wave of the pandemic eased in Hungary. It appears that Gólya has expanded not only its work fields, during the lockdowns, Gólya also provided employment opportunities in other sectors. The activities carried out outside the bar created new job opportunities for those affected, particularly after the bar was temporarily closed due to quarantine measures.

Cargonomia, while also affected by restrictions that halted workshops and trainings, used the pandemic as a moment of reflection and recalibration. Moreover, the demand for organic agricultural products, which are essential to Cargonomia, surprisingly increased during the pandemic. In a video interview with one of Cargonomia's partner initiatives, Zsamboki Biokert (YouTube video, 24 June 2020), it is stated that at first there was a shock, and orders for organic vegetables decreased. However, later, more people began ordering and preferring home delivery with cargo bikes. For them, it was testing the ground for what happens when the food or social systems are under pressure. People were clearly panicking about food. However, establishing resilient, sustainable, local, and organic systems is a strong solution. Another member of Cargonomia also addressed this issue:

"After the curfews began, we started focusing on what we could do in this situation. I cannot say we are doing so well, but gardening and organic farming have become very popular. So nowadays, we are dealing with gardening. What we are doing is meaningful. I mean, there is a pandemic and an economic collapse worldwide, but what we are doing is local, meaningful, and important" (Cargonomia member 3).

From a resilience perspective, these changes may indicate that local production systems are often better equipped to manage crises. By relying on shorter supply routes and flexible exchanges based on mutual support, local production and consumption can serve as a resilient alternative, particularly during health crises like COVID-19, which greatly limit close and face-to-face interactions. Yet the same Cargonomia member also emphasized the limits of remote or suspended activities, underscoring the relational nature of their work:

"But nowadays, it has started to be a bit much, because what we are doing is based on events and on relationships. These relationships only work if you have face-to-face interactions. It feels so unfair that, in the name of saving the economy, only activities involving monetary transactions are allowed. People are allowed to go out if they are going to work or shopping. Where the money flows, movement is permitted; where it does not, you cannot go anywhere. We are still maintaining our organization, but not much is happening" (Cargonomia member 3).

This highlights a key tension: while solidarity-based and diversified organizational practices expanded resilience, the temporary erosion of physical community spaces weakened those relational infrastructures that cooperatives rely on most. This excerpt also reveals another critical tension in how pandemic policies reinforced market logics: mobility was permitted when tied to paid labor or consumption, while non-monetary, community-oriented activities were constrained. For Cargonomia, whose work revolves around relationship-building, collective events, and alternative economic exchanges, this created a disadvantage.

Overall, both cooperatives demonstrated notable capacity to adjust to the rapidly shifting conditions of the pandemic. Their experiences suggest that resilience was not simply a matter of survival but of actively reconfiguring practices to preserve community well-being, maintain livelihoods, and uphold shared values under pressure. In this sense, Gólya and Cargonomia's responses reinforce the broader argument that cooperatives' participatory governance, long-term orientations, and dense solidarity networks function as mutually reinforcing pillars of resilience, particularly during challenging times.

7. Concluding Remarks

This paper contributes to the literature on collective forms of resilience by reaffirming that cooperatives exhibit strong adaptive capacities during crises when they prioritize participatory organizational practices, adopt long-term governance orientations, and build solidarity networks. The cases of Gólya and Cargonomia illustrate how these key principles enabled them to withstand and respond to the challenges posed by the COVID-19 pandemic.

Cooperatives are inherently designed to meet the needs of their communities, even in times of uncertainty. The findings suggest that both cooperatives successfully adjusted their operations to the new conditions and actively worked toward recovery throughout the pandemic period. Participatory and collective governance strengthened members' sense of belonging and engagement, contributing positively to organizational resilience. Likewise, a long-term orientation enabled these cooperatives to anticipate structural changes, align their activities with broader sustainability goals, and maintain continuity despite external shocks. Following Korber and McNaughton's (2017) framing, entrepreneurial resilience extends beyond preparedness or coping; it constitutes a dynamic process of positive transformation and forward-looking socio-economic planning. Cooperatives are particularly well positioned to cultivate this form of resilience by aligning economic practice with social and environmental commitments.

Another central finding concerns the role of solidarity networks. Strengthening solidarity ties, both internally among members and externally with allied organizations, equipped Gólya and Cargonomia with alternative economic and social resources that reduced their vulnerability to market fluctuations. Such solidarity-based exchanges offer a viable contrast to profit-centered market logics and demonstrate how cooperatives can generate more sustainable and equitable forms of economic coordination. As the examples in the paper show, cooperatives can mobilize diverse solidarity networks to support their sustainability during crises, especially when their organizational models are not driven exclusively by profit maximization.

However, it is important to acknowledge that cooperative resilience does not imply immunity from crisis impacts. Similar to cooperatives across Europe (Cooperatives Europe, 2020), both organizations experienced disruptions to their business activities and to their core practices of social interaction, which were constrained by physical distancing measures. This study focused on how cooperatives responded to these challenges, adapted their organizational practices, and supported

their members—reflecting the broader understanding that cooperatives operate not merely as market actors but as community-oriented institutions.

Despite facing economic and social pressures, Gólya and Cargonomia adapted their *modus operandi* to mitigate the effects of the pandemic—illustrating several concrete mechanisms through which cooperative resilience is enacted. In Gólya's case, rather than reducing staff, members and member-candidates displaced from bar work were redistributed across other activity blocks, such as bike-messenger services and construction work. This internal labour reallocation not only preserved employment but also reflected the cooperative's commitment to collective responsibility. Wages were likewise renegotiated collectively and redistributed according to need: members with fewer financial obligations, or those who had savings, voluntarily accepted reduced remuneration so that others—such as members with children or lower-earning roles—could receive more. This practical application of solidarity-based income sharing exemplifies how participatory decision-making can translate into tangible forms of crisis support.

Cargonomia, though also affected by restrictions on face-to-face activities, drew on a different set of resilient practices rooted in its long-term orientation toward degrowth-inspired, low-carbon local production. While workshops, community events, and educational programmes had to be suspended, the cooperative relied on its organic food distribution system and cargo-bike logistics to sustain operations. Demand for organic produce increased after an initial shock, reinforcing the value of short food supply chains during periods of systemic disruption. Moreover, Cargonomia's relationships with partner initiatives—such as the Zsámboki Biokert farm and the community cargo-bike sharing system—enabled it to continue meeting community needs even under mobility restrictions. The cooperative also supported fellow organisations: during its temporary displacement from its community space, Cargonomia was hosted by Gólya, while Gólya, in turn, made use of Cargonomia's cargo bikes to develop messenger services during lockdowns. These reciprocal, non-monetary exchanges further demonstrate how solidarity networks function as practical resilience strategies.

In conclusion, while this study does not claim generalizability from the two cases examined, it highlights the value of examining cooperative responses to crises—particularly natural and systemic crises such as the COVID-19 pandemic. Further empirical research is needed to broaden our understanding of how collecitve forms of governance, long-term strategy, and solidarity networks interact to foster resilience under varying types of disruptions.

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8. References

Ádám, Z. & Czerván, A. (2020). New solidarity initiatives as an important ground for building transformative politics: A conversation on solidarity economy praxis in Hungary. Lefteast. Retrived from https://lefteast.org/?s=%C3%81d%C3%A1m+and+Czerv%C3%A1n

Angeler, D.G. & Allen, C.R. (2016). Quantifying resilience. Journal of Applied Ecology, 53(3), 617-624.

Aldrich, H. E. & Martines, M. A. (2001). Many are called, but few are chosen: An evolutionary perspective for the study of entrepreneurship. Entrepreneurship

Theory and Practice, Baylor University.
Billiet, A., Frédéric, D., Stefanie, F. & Matthias, S. (2021). The resilience of the cooperative model: How do cooperatives deal with the COVID-19 crisis? Strategic Change, 30, 99–108.
Birchall, J. (2011). People-centred businesses: Co-operatives, Mutuals and theIdea of Membership. Palgrave Macmillan
Birchall, J. (2013). The potential of co-operatives during the current recession; Theorizing comparative advantage. Journal of Entrepreneurial and Organizational Diversity, 2 (1), 1-22.
Birchall, J. & Ketilson, L.H. (2009). Resilience of the cooperative business model in times of crisis. Sustainable Enterprise Programme. Geneva: ILO.
Cargonomia. (2020). Zsamboki Biokert in time of Covid-19 - Intw with Matthew Hayes.(Youtube video). Retrieved from https://www.youtube.com/watch?v=usnEYNwz7Is
Cargonomia. (n.d.). Who we are. Retrieved from https://cargonomia.hu/our-history/
Cooperatives Europe. (2020). Survey report:The COVID-19 crisis and its economic and social impact on cooperatives across Europe. Cooperatives Europe. Retrieved from https://coopseurope.coop/resources/news/survey-report-covid- 19-impact-cooperatives
Cracogna, D., Fici, A. & Henrÿ, H. (Eds.). (2013). International Handbook of Cooperative Law. Heidelberg: Springer.
Chine-CEE Institute. (2020). Hungary social briefing: jobs and Covid-19 in Hungary. Retrieved from https://china-cee.eu/2020/09/30/hungary-social-briefing-jobs-and-covid-19-in-hungary/
CICOPA. (2021). Covid 19: How cooperatives in industry and services are responding to the crisis. CICOPA. Retrieved from https://www.cicopa.coop/news/covid19-how-cooperatives-in-industry-and-services-are-responding-to-the-crisis/
Dash, A. (2014). Toward an Epistemological Foundation for Social and Solidarity Economy. Occasional Paper 3 Potential and Limits of Social and Solidarity Economy. UNRISD.
Dave, M. (2021). Resilient to crises: how cooperatives are adapting sustainably to overcome COVID-19- induced challenges. International Journal of Rural Management. 1–27.
Degrowth. (2020). A degrowth perspective on the coronavirus crisis. Retrieved from https://www.degrowth.info/en/2020/03/a-degrowth-perspective-on-the-coronavirus-crisis/
Franco, M., Haase, H., & Antonio, O. D. (2020). Influence of failure factors on entrepreneurial resilience in angolan micro, small and medium-sized enterprises. International Journal of Organizational Analysis, 29(1), 240-259.
Gagyi, Á. (2019). Solidarity Economy & the Commons in Central & Eastern Europe.Green European Journal. Retrived from https://www.greeneuropeanjournal.eu/solidarity-economy-and-the-commons-implications-for-central-and-eastern-europe/
G. Fekete É., Hubai, L., Kiss, J. & Mihaly, M. (2017). Social enterprise in Hungary. ICSEM Working Papers, 47, Liege: The International Comparative Social Enterprise Models (ICSEM) Project.
Gólya (n.d.). A Szövetkezet. Retrived from https://www.golyaszovetkezet.hu/
Gólya. (2021). April 19. Munkatársakat Keresünk! (Facebook update).Retrieved from https://www.facebook.com/roncskocsma/photos/a.625090220835430/4254385327905883/?type=3&theater

Hale, J. & Carolan, M. (2018). Cooperative or uncooperative cooperatives?: Digging into the process of cooperation in food and agriculture cooperatives. Journal of Agriculture, Food Systems, and Community Development, 8(1), 113–132.

Hui, E.K. (2006). Reasons for the increase in emerging and re-emerging viral infectious diseases. Microbes Infect, 8(3), 905-16.

ICA. (2013) Blueprint for a co-operative decade. Geneva: ICA

ICA. (2018a). Cooperative identity, values & principles. Retrieved from https://www.ica.coop/en/cooperatives/cooperative-identity

ICA. (2018b). What is a cooperative? Retrieved from https://www.ica.coop/en/cooperatives/what-is-a-cooperative

ILO. (2016). Cooperation in a changing world of work: Exploring the role of cooperatives in the future of work. Cooperatives and the World of Work Series. Geneva: ILO.

ICA. (2020). Exploring the cooperative economy report. World Cooperative Monitor. ILO. (2020a). COVID-19 and the world of work: Impact and policy responses. 1st

Edition. Retrieved from https://www.ilo.org/global/about-the-ilo/WCMS_738753/lang--en/index.htm

ILO. (2020b). COVID-19 causes devastating losses in working hours and employment. Retrieved from https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_740893/lang--en/index.htm

Kafkadesk. (n.d.). Meet Cargonomia, the eco-friendly cooperative championing degrowth in Budapest. Retrieved from https://kafkadeskdotorg.wordpress.com/2019/10/01/meet-cargonomia-the-eco-friendly-cooperative-championing-degrowth-in-budapest/

Kelly, E. (2020). Pandemic crash shows worker co-ops are more resilient than traditional business. Interviewed by Brian Van Slyke for Truthout. 8 May. Retrieved from https://truthout.org/articles/pandemic-crash-shows-worker-co-ops-are-more-resilient-than-traditional-business/

Kiss, J. & Mihály, M. (2019). Social Enterprises and Their Ecosystems in Europa.

Country report: Hungary. Publications Office of the European Union.

Korber, S. & McNaughton, R. (2017). Resilience and entrepreneurship: A systematic literature review. International Journal of Entrepreneurial Behaviour & Research, 24(7), 1129-1154.

Kulturanova. (n.d.). Gólya Community House and Cooperative Pub Budapest, Hungary. Retrieved from https://participatory-governance.kulturanova.hr/survey/item/405

Mangan, A., & Ward, A.-M. (2023). Cooperative resilience: Toward a heuristic model of collective action in a crisis. Financial Accountability & Management, 40(3), 308–325

Manzano-Garcia, G. & Ayala Calvo, J.C. (2013). Psychometric properties of Connor-Davidson Resilience Scale in a Spanish sample of entrepreneurs. Psicothema, 25(2), 245-251.

Marci, B. (2019). Gólya: cooperative management in Budapest. (*Interview by Greta Rauleac).* Cooperative City. Retrieved from https://cooperativecity.org/golya-cooperative-management-in-budapest/

Miner, K. (2023). Transformational Resilience and Future-Ready Cooperative Governance Systems. In: Novković, S., Miner, K., McMahon, C. (eds) Humanistic Governance in Democratic Organizations. Humanism in Business Series. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-17403-2_13

Mohan, V. (2020). Cooperatives absorb Covid shock, help milk farmers beat crises. Retrieved from https://timesofindia.indiatimes.com/india/cooperatives-absorb-covid-shock-help-milk-farmers-beat-crisis/articleshow/78852587.cms

MTI-Hungary Today. (2020). Number of unemployed rose in september. Retrieved from https://hungarytoday.hu/hungary-unemployed-jobless-september-2020/

Myers-Smith, I.H., Trefry, S.A. & Swarbrick, V.J. (2012). Resilience: easy to use but hard to define. Ideas in Ecology and Evolution, 5(1), 44-53.

Narvaize, L., Aragon-Amonarriz, C., Iturrioz-Landart, C., Bayle-Cordier, J. & Stervinou, S. (2017). Cooperative dynamics during the financial crisis: Evidence from Basque and Breton case studies, Non-profit and Voluntary Sector Quarterly, 46(3), 505–524.

Nelson, A. & Liegey, V. (2025). Degrowth Has Come of Age. In Routledge Handbook of Degrowth. (Ed. Anitra Nelson). Routledge.

Newport, R. (2020). Pandemic crash shows worker co-ops are more resilient than traditional business. Interviewed by Brian Van Slyke for Truthout. 8 May. Retrieved from https://truthout.org/articles/pandemic-crash-shows-worker-co-ops-are-more-resilient-than-traditional-business/

Novkovic, S., & Webb, T. (Eds.). (2020). Co-operatives in a post-growth era: Creating co-operative economics. Zed Books.

OECD.(2020).Hungary. OECD Economic Outlook. Retrieved from https://www.oecd-ilibrary.org/sites/c4a76393-en/index.html?itemId=/content/component/c4a76393-en

Parnell, E. (2001) The role of cooperatives and other self-help organizations in crisis resolution and socio-economic recovery. International Labor Organizations (ILO).

RIPESS Europe (2023). Cargonomia in Budapest: bicycle and degrowth. Retrieved from https://ripess.eu/en/cargonomia-in-budapest-bicycle-and-degrowth/

Roelants, B., Dovgan, D., Eum, H. & Terras, E. (2012). The resilience of the cooperative model: how worker cooperatives, social cooperatives and other worker-owned enterprises respond to the crisis and its consequences. CICOPA EUROPE.

SEC. Who we are? Retrived from https://szolidarisgazdasagkozpont.hu/kikvagyunk Saner, R., Yiu, L. & Filadoro, M. (2012). Cooperatives for inclusive growth.

CSEND. Policy Brief, 101. Geneva.

Smith, S. C. & Rothbaum, J. (2013). Cooperatives in a global economy: key economic issues, recent trends, and potential for development. IZA Policy Paper, 68. Germany: IZA.

Smith, S. (2014). Promoting cooperatives: an information guide to ILO recommendation. No.193, Geneva: ILO.

Simbarashe, K., Marizvikuru, M. & Joseph, F. (2018). Approaches to measuring resilience and their applicability to small retail business resilience. Problems and Perspectives in Management, 16(4), 275-284.

The Manila Times. (2020). Cooperatives amidst the pandemic, stand for resiliency, strive for sustainability. Retrived from https://www.manilatimes.net/2020/10/10/supplements/cooperatives-amidst-the-pandemic-stand-for-resiliency-strive-for-sustainability/778506/

UN. (2020). Policy Brief: The Impact of COVID-19 on Women. Retrieved from https://www.unwomen.org/en/digital-library/publications/2020/04/policy-brief- the-impact-of-covid-19-on-women

UN News. (2021). COVID's led to 'massive' income and productivity losses, UN labour estimates show. Retrieved from

https://news.un.org/en/story/2021/01/1082852

UNDP. (2020). Sustaining livelihoods through cooperatives during COVID-19. Retrived from https://www.np.undp.org/content/nepal/en/home/stories/Sustaining-livelihoods- through-cooperatives-during-COVID-19.html

WHO. (2020). Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19). Retrieved from https://www.who.int/publications/i/item/report- of-the-who-china-joint-mission-on-coronavirus-disease-2019-(covid-19)

WHO. (2021). Coronavirus. Retrieved from https://www.who.int/health-topics/coronavirus#tab=tab_1

WHO. Coronavirus (COVID-19) Dashboard. Retrieved from https://covid19.who.int/ World Economic Outlook. (2020). A crisis like no other, an uncertain recovery.

International Monetary Fund (IMF). Retrieved from https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune 2020

Vieta, M. & Lionais, D. (2015). Editorial: The Cooperative Advantage for Community Development, *Journal of Entrepreneurial and Organizational Diversity*, European Research Institute on Cooperative and Social Enterprises, vol. 4(1), pages 1-10, August.

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