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Circular by Design? Rethinking Trade Secret Protection and Data Governance in the EU Circular Economy

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Abstract The European Union has embraced the circular economy as a cornerstone of its transition toward climate neutrality and long-term resource efficiency. This paper, however, argues that the promise of circularity is undermined by the structural misalignment between environmental policy objectives and the legal frameworks governing intellectual property rights (IPRs) and data governance. While recent measures such as the Ecodesign for Sustainable Products Regulation (ESPR), the Right to Repair Directive (R2R), and the Data Act introduce mechanisms for data sharing, design transparency, and repairability, their effectiveness is constrained by entrenched logics of exclusivity and secrecy. In particular, trade secret protection – potentially indefinite and broadly defined – remains a systemic barrier to information flows that are indispensable for repair, reuse, remanufacturing, and interoperability. The paper advances the concepts of "circular IPRs" and "circular data" to reframe these regimes as mutually reinforcing pillars of a legal order capable of sustaining circularity. It contends that realizing the EU's circular ambitions requires a paradigm shift: from exclusivity and secrecy toward openness and collaboration and from proprietary control toward infrastructural access and circularity. By aligning IPR reform and data regulation around openness, collaboration, and ecological imperatives, the EU can build the legal foundations for truly circular innovation.

Keywords Circular economy · IPRs · Trade secrets · Data governance · European Union law · Right to repair

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1 Introduction

The European Green Deal envisions a fundamental transformation of the European Union (EU) economy toward climate neutrality and long-term resource efficiency by 2050.[1] At the heart of this vision lies the transition to a circular economy – an economic model designed to minimize waste and maximize the value and longevity of materials, components, and products.[2] This shift challenges the dominant logic of the linear economy, which has long structured production and consumption according to a "take–make–use–dispose" model.[3] While linearity[4] enabled decades of industrial expansion, it now stands in stark contrast to the ecological and social imperatives of the twenty-first century: climate crisis, resource scarcity, and systemic waste.

In place of this extractive logic, the circular economy promotes closed loops of material flows, in which products are reused, repaired, remanufactured, or recycled rather than discarded. These so-called R-activities, or R-strategies,[5] represent the operational backbone of circularity. Reusing refers to the employment of a product again for its original purpose without significant alteration. Repairing involves restoring defective goods to working condition, thereby extending their usable life. Refurbishing refers to the process of repairing, cleaning, and restoring products to a functional condition suitable for resale or reuse, though not necessarily to the standard of a new product.[6] Remanufacturing entails disassembly and comprehensive rebuilding so that the product meets "like-new" specifications, often accompanied by warranties similar to those provided with new goods.[7] Repurposing

[1] European Commission (2019).

[2] Ellen MacArthur Foundation (2015); Blomsma and Brennan (2017), p. 603; Figge et al. (2023); Kirchherr et al. (2017), p. 221.

[3] This model relies on the extraction (take) of natural resources, their transformation (make) into products, their consumption (use), and ultimately their disposal (dispose) as waste; Michelini et al. (2017), p. 2. Furthermore, this system often permits goods – particularly technological ones – not only to become unusable within artificially limited lifespans but also to resist reuse or repair due to a lack of spare parts and insufficient information on repair processes; *see* Maggiolino (2019), p. 405.

[4] As a terminological premise, this paper employs the terms "linear"/"linearity" and "circular"/"circularity" as shorthand for sets of practices and legal regimes that underpin either the take-make-dispose economic model or a regenerative, resource-efficient circular economy.

[5] The term "*R-strategies*" (or "*R-activities*") evolved from the foundational "3Rs" framework – *Reduce*, *Reuse*, *Recycle* – but its precise origin is difficult to attribute to a single author or source. The concept gradually expanded throughout the 2000s and 2010s to include a broader range of circular practices, such as *Repair*, *Refurbish*, *Remanufacture*, and *Repurpose*. It became increasingly common in academic and policy literature as circular economy discourse matured. Foundational contributions that shaped the intellectual environment for this expansion include Stahel and Reday-Mulvey (1981); McDonough and Braungart (2010).

[6] Reike et al. (2022), p. 47.

[7] *Caterpillar remanufactures* used heavy-machinery parts by disassembling and rebuilding them to like-new condition, saving raw materials and energy that would otherwise be spent in the production of new parts. *See* Helbig and Hillenbrand (2024).

designates the adaptation of a product or component for a new function that differs from its original use.[8] Finally, recycling describes the processing of discarded materials – typically through chemical or mechanical means – to extract and reuse raw inputs in new production cycles.[9]

By enabling these activities at different stages of the value chain, the circular economy model aims to reduce resource input and waste output simultaneously. The EU has embraced this transformation as a strategic priority, as reflected not only in the European Green Deal but also in a broader set of policy instruments, such as the Circular Economy Action Plans,[10] which gradually shifted the policy focus from waste treatment to product design and lifecycle management.

Within this overarching framework, the EU's commitment is articulated through a growing body of legislative instruments. These include Directive 2024/1799 on the Right to Repair (R2R Directive),[11] which has solidified the legal standing of repair as a consumer right and an industrial obligation, and the 2024 Ecodesign for Sustainable Products Regulation (ESPR),[12] which expands the scope of EU product policy to include environmental performance across the entire lifecycle. Collectively, these measures mark a systemic reorientation of EU economic governance – embedding circularity not just as a matter of environmental concern, but as a structural imperative within product, consumer, and internal market law.

However, this paper contends that the EU's ambitious vision for a circular economy is hindered by a structural misalignment between its policy objectives and the existing legal frameworks governing intellectual property rights (IPRs) and data governance. While environmental regulation and product policy have evolved to promote circularity, the intellectual property and data governance regimes largely remain anchored to the logic of the linear, exclusion-driven economy, and the narratives of ownership respectively. IPRs frequently limit access to essential resources such as repair manuals, technical schematics, and spare parts. This, in turn, impedes the implementation of key circular strategies, including repair, reuse, and remanufacturing. More significantly, restrictive data practices – especially those stemming from the expansive protection of trade secrets – pose substantial obstacles to activities like reverse engineering, innovation, and third-party repair. These constraints not only consolidate control in the hands of original manufacturers but also erode the operational viability of circular economy models at scale.

The above raises the question as to whether – and how – IPRs and data governance regimes should be reframed to enable more circularity. While emerging literature has begun to interrogate the compatibility of IP law with sustainability

[8] *Shipping containers are commonly repurposed* into homes or offices, reflecting a growing trend in sustainable architecture. *See* Reike et al. (2022).

[9] *Upcycling* shares the goals of prolonging material use with the R-activities but differs in its focus on creativity and value enhancement. *See* Singh (2022).

[10] European Commission (2015, 2020a, b).

[11] Directive (EU) 2024/1799 (2024).

[12] Regulation (EU) 2024/1781 (2024).

goals,[13] a systematic examination of how both IPRs and data regimes must evolve together to support R-activities remains underdeveloped. This paper seeks to fill this gap. It introduces the dual concepts of "circular IPRs" and "circular data", and exposes the structural tensions – particularly surrounding trade secret protection – that hinder the development of a legal framework enabling the circular economy. In doing so, it identifies IP and data governance regimes as the twin pillars that must be restructured to enable a functional legal foundation for the circular economy, and contends that even a reimagined IP regime will fall short unless accompanied by a robust framework for data access, sharing, and reuse. More specifically, the paper argues that to make circularity legally operable, trade secrets must be retooled to support collaboration, access, and sustainability-oriented innovation, and data governance must shift from a market-based logic to one grounded in the public interest.

This paper proceeds in five sections. The next section begins the legal analysis by examining how key IPRs – specifically trademarks, patents, copyright, and design rights – are structurally aligned with a linear economic model. It explores how these rights, while designed to incentivize innovation and regulate access to markets, can obstruct R-activities that are foundational to circularity. The section also highlights certain internal flexibilities or "seeds of circularity" – such as exhaustion principles and specific exceptions – that could serve as potential leverage points for reform. Section 3 introduces the concept of "circular data", emphasizing that data should not be regarded merely as a tradable asset, but rather as a form of infrastructure. This perspective stems from the growing recognition of the central role of data not only in enabling R-activities, but also in supporting the operation of emerging circular business models. Section 4 examines the EU's evolving data governance framework – focusing on the Data Act,[14] the ESPR and the R2R Directive. It evaluates the extent to which these instruments facilitate data flows in line with circular economy objectives. Section 5 then turns to trade secrets, framing them as the strongest – and often underexamined – legal barrier to IP circularity. This analysis is developed in dialogue with the concept of data circularity, and argues that seeds of circularity can be found within the trade secrets protection regime, and outside, in the Data Act and in the ESPR. However, at the current state, this is not enough to achieve the objective of establishing a circular economy. Section 6 concludes by calling for a reorientation of regulatory priorities: from exclusivity and secrecy toward openness and collaboration and from proprietary control of data toward infrastructural access and circularity.

[13] *See*, *inter alia*, Pihlajarinne and Ballardini (2020), p. 239; Ballardini and Pihlajarinne (2019), p. 152; Rimmer (2018), p. 235; Sarnoff (2016), p. 334; Rimmer (2011); Derclaye (2008), p. 265; Drahos (2016), p. 92; Drahos (2011).

[14] Regulation (EU) 2023/2854 (2023); Regulation (EU) 2022/868 (2022), Recitals 17, 20, 21; Regulation (EU) 2023/2854 (2023), Recitals 13, 16, 30.

2 IPRs in the Linear Economy

The shift toward a circular economy has profound implications not only for industrial design and production systems but also for the legal regimes that govern access, control, and innovation. R-activities depend on access to products, components, and technical information – resources often protected under various IPRs. As such, their role in the circular economy has become a focal point of debate, particularly regarding their potential to either obstruct or enable key circular practices.

Originally designed to incentivize invention and reward innovation through exclusivity, IPRs must now be re-evaluated in the light of the operational demands of circularity. Therefore, the question is no longer simply how to protect innovation, but how to do so without undermining sustainability goals.

The following subsections unpack this tension by analysing how different IPRs interact with R-activities, identifying legal barriers that inhibit circular practices, and highlighting existing doctrines that may offer a foundation for a more circular-compatible IP framework.

2.1 The Problem of "Linear IPRs"

IPRs serve three principal functions: they (i) incentivise the creation of new products and services; (ii) grant exclusive rights that empower holders to exclude third parties from manufacturing, distributing, or modifying protected goods; and (iii) control the downstream use, reuse, and disposal of those goods. These features position IPRs as structural enablers of the linear economic model, permitting rights holders to extend their control far beyond the initial market placement – often to the extent of constraining R-activities.[15]

A prominent illustration of this dynamic is found in the Norwegian Apple case, in which the company relied on its trademarks to prevent the importation and sale of refurbished iPhones.[16] The devices in question incorporated components – such as screens – that bore Apple's trademarks, although the marks were not visible to end users. While the district court ruled in favour of the independent repairer, Apple ultimately prevailed before the Norwegian Supreme Court, which held that the presence of both original (trademark-bearing) and non-original parts rendered the devices counterfeit.[17] The decision drew criticism from circular economy advocates,[18] who viewed it as an example of trademark law overriding the exhaustion principle, which generally limits a rights holder's control once a product has been lawfully placed on the market – unless its condition has been materially

[15] Ballardini et al. (2021); Derclaye (2008), p. 265.

[16] Supreme Court of Norway (2020); Stenvik (2021); Tischner and Stasiuk (2023).

[17] The judgment is in line with the orientation of EU case law which, in upholding infringement in the case of the modification of trademarked products after they have been put on the market, points out that even attempts to avoid this result by removing the mark on spare parts constitute infringement, as occurred in the Apple case; *see* CJEU (2018), ECLI:EU:C:2018:594.

[18] Mikolajczak (2020).

altered. Specifically, it is well established that the rights conferred by IPRs are exhausted once the product has been placed on the market. This means that a trademark holder should not be able to prevent modifications to a product once it has been sold. However, the exhaustion principle does not apply if the trademark holder has a legitimate reason to oppose further commercialization of the goods, particularly if the condition of the goods has been altered or impaired after their market entry.[19] Thus, those R-activities that involve substantial modifications to products could be deemed to be infringements.[20]

Patent protection presents a similar challenge. Although repair is generally permitted under the doctrine of exhaustion,[21] the boundary between repair and reproduction is often blurred[22] – particularly in relation to complex assemblies, embedded software, or remanufacturing processes. During repair, remanufacturing, and refurbishment, activities such as reproducing a patented invention, a protected design, or software embedded in a product are likely to occur.[23] The principle of exhaustion has also proven difficult to apply in practice, leading to situations in which patent holders have sought to restrict its scope, thereby undermining the long-term usability and repairability of their products.[24]

Copyright and design rights can also frustrate circular practices. These rights frequently cover not only the final product but also its associated technical documentation, embedded code, and the design of spare parts. Consequently, rights holders may restrict access to repair manuals, diagnostic tools, and interoperability interfaces, placing significant legal barriers in the way of routine maintenance, reverse engineering, and component reuse.[25]

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[19] Directive (EU) 2015/2436 (2015), Art. 15(1). In particular, Art. 15 provides that "[a] trade mark shall not entitle the proprietor thereof to prohibit its use in relation to goods which have been put on the market in the Union under that trade mark by the proprietor thereof or with his consent"; however, this principle does not apply when "there exist legitimate reasons for the proprietor to oppose further commercialisation of the goods, in particular where the condition of the goods is changed or altered after they have been put on the market". In this regard, *see* Hilty (2021), p. 272.

[20] Pihlajarinne (2020), p. 111.

[21] For an overview of relevant decisions, *see* Heath (2014), p. 419.

[22] Hilty and Batista (2023).

[23] Heath (2009), p. 85. In 2004, the Dutch Supreme Court ruled that replacing the coffee capsules of a patented coffee preparation apparatus did not constitute indirect infringement. The Court held that not every component necessary to use the patented invention qualifies as an essential part of the invention. Otherwise, even the hot water used to prepare the coffee would have to be considered an essential part of the invention. Dutch Supreme Court 2003 (BIE 2004, 285); Brinkhof (2006).

[24] Pihlajarinne (2021), p. 81.

[25] Additionally, right holders tend to adopt practices that *de facto* limit R-activities, such as digital locks, so as to exercise control on elements – data for example – that are not protected under any IPR. An example is the practice of making some of the functionalities of mobile phones stop working when the screen is replaced. On top of this, limitations to R-activities are often inserted in licensing agreements to prevent lawful acquirers from disassembling products.

2.2 Seeds of Circularity in Existing IP Law

Despite the structural tensions, existing IPRs are not wholly incompatible with the objectives of a circular economy. Embedded within current regimes are several doctrines and legal mechanisms that may be leveraged to support R-activities.

Among these "seeds of circularity", a foundational doctrine is the above-mentioned principle of IP exhaustion, which limits a rights holder's control over a product once it has been lawfully placed on the market. Upon exhaustion, further resale, use, or even modification of the product may occur without constituting infringement.[26] While the doctrine does not apply unconditionally – particularly where the product's condition has been materially altered – it provides a legal foundation for the secondary markets, repair-based services, and re-use models that are integral to circularity.

A more structurally ambitious mechanism is compulsory licensing. In both patent and copyright law, compulsory licences may be issued under specific conditions, typically grounded in safeguarding public interests such as health, security, or innovation.[27] Although rarely invoked in environmental contexts, this mechanism could, in principle, be adapted to advance circular economy goals – for instance, by enabling access to the proprietary schematics, replacement components, or interoperability information necessary for repair and remanufacturing. While legal and political obstacles to such a shift remain significant, reframing compulsory licensing through the lens of environmental necessity could broaden its functional scope and policy legitimacy.

In addition, several statutory exceptions and limitations within EU IP law are directly relevant to circular economy practices. For instance, Art. 5(3)(l) of the InfoSoc Directive (Directive 2001/29/EC)[28] permits the use of copyrighted works "in connection with the demonstration or repair of equipment" – an explicit, albeit narrow, acknowledgement of repair-related functionality. Similarly, Art. 110(1) of the Community Design Regulation (Regulation No 6/2002) contains the so-called "must-match" clause, which allows for the manufacture and sale of spare parts that are necessary to restore the appearance of complex products – such as car body parts – provided certain conditions are met.[29] This provision has been substantially strengthened through the EU's ongoing reform of industrial design law. In the revised Design Directive,[30] Art. 19 explicitly confirms that design protection shall not apply to spare parts used for repair purposes, so long as their use restores the

[26] Perzanowski (2020); Pihlajarinne (2020) (Oslo Research Paper 2020-32).

[27] In particular, *see* the recent European Commission (2025) (Compulsory Licensing Compromise Text).

[28] Rosborough (2022), p. 113.

[29] Beldiman and Blanke-Roeser (2015).

[30] Directive (EU) 2024/1799 (2024).

original appearance of a complex product. Aligned with the broader "right to repair" initiative, this revision is expected to liberalise the spare parts market and improve access for both consumers and independent repairers.[31]

In sum, while the prevailing logic of IP law remains oriented toward exclusivity and market control, these existing doctrinal footholds provide the basis for a more circular-compatible interpretation of IPRs. Properly extended and interpreted, they could serve as the legal infrastructure for a more enabling and sustainable IP regime.[32]

3 Beyond Circular IPRs: The Role of Data

Even if the EU were to succeed in developing an IP framework that genuinely supports circularity – through expanded exceptions, a clarified exhaustion doctrine, or strengthened repair clauses – this alone would not suffice. Circular IPRs, though essential, cannot function in isolation. Without access to the relevant data, circularity remains an incomplete vision.

Consider the case of an independent repairer, even an authorised one, attempting to repair a modern product. Access to technical schematics, diagnostic codes, and firmware updates is often indispensable for performing even basic repairs. Without this information, the practical implementation of R-activities is significantly hindered.

Access to data is therefore not merely complementary to circularity, but foundational. It is the enabler of sustainable resource management, lifecycle optimisation, and product longevity. Data provides insights into how products are designed, used, maintained, and ultimately discarded. These insights are critical for identifying inefficiencies, enabling effective repair, and designing reusable and recyclable products from the outset.

To support these developments, data must be treated not simply as a tradable asset but as an infrastructure[33] – a shared resource that enables collaboration, innovation, and regulatory oversight in the circular economy. This reconceptualization gives rise to what might be termed "circular data": data that enables, facilitates, or accelerates the implementation of R-activities across value chains.

[31] Moreover, Art. 5(3)(l) of Directive 2001/29/EC on copyright in the information society (Directive 2001/29/EC (2001), Art. 5(3)(l)) allows Member States to introduce exceptions or limitations to the prohibition on reproducing protected works, specifically in relation to their use for demonstrations or equipment repairs. As a result, since 2001, the dissemination of copyright-protected repair information – such as instruction manuals, guides, and diagrams – has not been considered infringement. Furthermore, Regulation (EC) 715/2007 (2007), Art. 6(1) mandates that car manufacturers, as owners of designs, make vehicle repair and maintenance information available to independent operators in a format suitable for subsequent electronic processing. This complex relationship between product repair information and copyright is further evidenced by the recent amendment to the Waste Framework Directive (Directive 2008/98/EC), specifically Art. 9(e), which encourages the availability of spare parts, instruction manuals, technical information, or other tools, equipment, or software necessary for repairing and reusing products, while still respecting intellectual property rights. On this topic, *see* Rosborough (2022), p. 113.

[32] Zoboli (2024).

[33] Frischmann (2012); Star and Ruhleder (1996), p. 111; Delacroix and Lawrence (2019), p. 236.

At the operational level, circular data includes a wide array of information: component specifications, product usage patterns, repair histories, material content disclosures, environmental impact metrics, and more. When accessible and interoperable, such data allows manufacturers, repairers, recyclers, and regulators to track materials, anticipate failure points, plan repairs, and manage reuse pathways.

Circular data also underpins regulatory enforcement. It enables public authorities to monitor compliance with environmental standards, detect greenwashing, enforce waste reduction targets, and ensure that product design aligns with circular economy principles. Without reliable data on product flows, materials, and performance, regulatory interventions risk becoming superficial or unenforceable.

Crucially, the role of data in the circular economy extends beyond operational efficiency and regulatory compliance – it is foundational to systemic collaboration and innovation. Data sharing between firms enables industrial symbiosis models, where the waste or by-products of one process become valuable inputs for another. In waste-to-value chains, accurate and interoperable data is essential to trace material flows and transform discarded goods into new products, components, or energy sources. Likewise, in circular supply chains, real-time data enables the tracking of parts and resources to optimize reuse, minimize waste, and prevent resource loss across multiple lifecycle stages.

Beyond facilitating R-activities, data also underpins the emergence of circular business models that depend on accurate, real-time data to monitor product use, anticipate maintenance, and maximise asset lifespan.[34] A notable example is the *Product-as-a-Service* (PaaS) model, in which manufacturers retain ownership of goods while offering access or functionality as a service. This "servitised" approach realigns incentives: instead of maximizing unit sales, firms are encouraged to prioritize durability, reparability, and upgradeability. By leveraging usage data, they can optimize product performance over time, extend lifespans through predictive maintenance, and enable multiple cycles of reuse or refurbishment.[35] In this way, this data-driven business model actively supports lifecycle extension, resource efficiency, and reduced environmental impact.[36]

Similarly, *circular supply chains*, which aim to eliminate waste and pollution by reusing or recycling materials, depend on data to track materials and manage the reuse or recycling process.[37] *Waste-to-value* models, which transform waste into valuable resources through recycling, upcycling, and other methods, also rely on data to monitor material flows and facilitate the conversion of waste into new products or energy.[38] Likewise, *industrial symbiosis* models, involving the exchange of materials, energy, and by-products between companies to minimize waste, heavily depend on data to identify potential resource exchanges between

[34] *See* Montagnani (2023).

[35] Tukker (2015); Ellen MacArthur Foundation (2015); Bressanelli et al. (2024).

[36] Alcayaga and Hansen (2019); Bressanelli et al. (2018); Bocken et al. (2018); Boldoczki et al. (2021); Roci and Rashid (2023).

[37] Gebhardt et al. (2022).

[38] Lüdeke-Freund et al. (2018).

Table 1 EU legal instruments for data-enabled circularity across the product lifecycle

Lifecycle stage	Legal instrument	Key mechanisms	Impact on circular economy
Design and manufacturing	ESPR	Sustainability-by-design obligations Material efficiency standards DPP obligation	Embedding circularity upstream; enabling informed choices and downstream reuse, repair, recycling; facilitating regulatory oversight
Use	Data Act	Article 4: User right to access connected devices' data Article 5: Connected devices data portability to third parties Article 35: Connected devices data interoperability & open formats	Supporting data-driven R-activities; enabling competition in aftermarkets (such as the repair services markets); empowering the development of innovative but non-competing products and services
Post-Use	R2R Directive	Mandatory access to spare parts and manuals Repairability scores Extended warranty repair obligations	Facilitating enforcement of repair rights; promoting product lifespan extension

industries, allowing businesses to find new uses for waste streams or surplus materials that would otherwise be discarded.[39] Finally, manufacturers adopting a *circular product design* model need data on consumer behaviour, product performance, conditions, and material composition to optimize repair, upgrades, resale, and material recovery, thereby extending product life, reducing waste, and supporting future production cycles.[40]

In all these cases, data operates as critical infrastructure – essential for moving from high-level circularity goals to tangible implementation.

4 The EU Framework on Data Circularity

The EU has adopted a growing body of legislation aimed at improving data availability, fostering interoperability, and embedding information flows throughout the product lifecycle. In particular, the Data Act, the ESPR, and the R2R Directive form the backbone of an emerging framework for "data circularity". These regulatory initiatives represent important steps forward, although their effectiveness remains uneven. While sharing a common overarching goal – alongside their measure-specific objectives: to establish the legal and technical conditions

[39] Järvenpää et al. (2021).

[40] Kumar et al. (2024).

necessary for data-enabled circularity – each of these instruments targets different stages of the product lifecycle (see Table 1).

The Data Act introduces binding obligations that give users of connected devices the right to access and share data generated through the use of those devices. Under Art. 4, data holders – typically manufacturers – must provide users with access to the data necessary to manage, repair, or maintain their products. Article 5 further empowers users to transfer this data to third-party service providers, thus facilitating competition in aftermarkets for repair, maintenance, and refurbishment. Article 35 promotes interoperability and open data standards, essential conditions for enabling data sharing across brands and platforms. Taken together, these provisions support the development of data-driven circular business models in the IoT sector, such as decentralised repair ecosystems and product lifecycle optimisation services.[41]

The ESPR, adopted in 2024, replaces the earlier Ecodesign Directive, and establishes a framework for imposing on specific product groups eco-design requirements relating to durability, circularity and the overall reduction of products' environmental and climate footprint, and the like. Among the most innovative features of the ESPR is the Digital Product Passport (DPP), a digital tool that stores structured, machine-readable information about a product's materials, repairability, durability, and environmental footprint. DPPs are intended to enhance transparency for manufacturers, consumers, repairers, and recyclers, thereby enabling smarter, more sustainable decision-making throughout a product's use and afterlife.

The R2R Directive strengthens this legal ecosystem by targeting the post-purchase phase. It requires manufacturers to make spare parts, repair manuals, and diagnostic tools available for a defined period after sale. It also introduces repairability scores to guide consumer choices and extends warranty rights, obliging manufacturers to repair – rather than replace – defective products within the warranty period. While the ESPR targets product design and the Data Act regulates data access, the R2R Directive ensures that circular-friendly design and data availability translate into enforceable consumer rights and practical repair solutions.

Taken together, these three instruments seem to establish a coherent legal framework that promotes data-enabled circularity throughout the design, use, and post-use phases. However, this framework still faces significant challenges and limitations. Chief among them, as this paper argues, is a persistent and unresolved legal tension: the excessive protection of trade secrets.

5 The Elephant in the Room: Trade Secret Protection

Among all IPRs, trade secrets present the sharpest and least resolved conflict with circularity.[42] Unlike patents or copyright, which are time-limited and premised on disclosure, trade secrets can protect commercially valuable information indefinitely, so long as secrecy is maintained.[43] This combination – durability in terms of

[41] For a critical view *see* Kerber (2024).

[42] *See*, for an example in the biotech sector, Van Overwalle (2012).

[43] Di Cataldo (2024).

protection and vagueness in terms of subject matter – aligns poorly with the needs of a circular economy, where access to critical technical knowledge for repair, reuse, and interoperability is essential.

Nonetheless, trade secret law is not entirely incompatible with circularity, encompassing, like the other IPRs, some seeds of circularity. In particular, the EU Trade Secrets Directive[44] contains limited but important openings. Most notably, it permits the reverse engineering of lawfully acquired products, unless explicitly prohibited by contract.[45] This means that, in principle, independent actors may dissect products to understand their components or functions – a practice that could support the development of compatible replacement parts or enable sustainable remanufacturing processes.

Moreover, Art. 5 of the Trade Secrets Directive introduces exceptions for whistleblowing and disclosures made in the public interest.[46] While its applicability to environmental sustainability remains largely untested, the provision could justify the release of trade secret-protected information in cases where transparency serves to expose ecologically harmful practices or promote more sustainable industry conduct. For instance, this article could be invoked in cases where revealing unsustainable practices compels manufacturers to adopt more environmentally responsible behaviours.

In theory, these openings could support sustainable remanufacturing or justify disclosures exposing ecologically harmful practices. In practice, however, they remain narrow, underdeveloped, and largely untested in the context of the circular economy. As a result, trade secret law functions like an exclusive tool. It entrenches information asymmetries, reinforces product lock-in, and risks hollowing out the EU's circular reforms by allowing secrecy claims to override data-sharing mandates. For the circular economy to become legally operable, this imbalance must be addressed: trade secrets need to be recalibrated not to disappear, but to coexist with the transparency, interoperability, and knowledge diffusion on which circularity depends.

5.1 Trade Secrets and Circular Data

Limits to data secrecy – other seeds of circularity, but which are confined to specific categories of data – do not emerge from the Data Act and the ESPR. While the Data Act prioritises data sharing, it explicitly recognises that some of the data subject to mandatory access obligations may qualify as trade secrets under the Trade Secrets Directive. Accordingly, the regulation introduces mechanisms to manage the circulation of such protected data, coupled with a narrowly framed exception that permits refusal of access in certain cases.[47]

The general principle, set out in Arts. 4(6) and 5(9), is that trade secrets must be preserved when data is shared with users or third parties, and that disclosure may

[44] Directive (EU) 2016/943 (2016).

[45] *See* Surblytė (2016).

[46] Abazi (2016); Homewood and Lewis (1999).

[47] De Noyette, Stähler and Margoni (2025), pp. 984–1014

only occur to the extent strictly necessary to achieve the agreed purpose. To give effect to this principle, the Data Act requires trade secret holders to identify the elements of a dataset that qualify as trade secrets – potentially through metadata – and to agree with the recipient on proportionate safeguards. These safeguards may take the form of model contractual terms, confidentiality agreements, strict access protocols, technical standards or codes of conduct, thereby embedding confidentiality obligations into the process of data sharing.

If no agreement on such safeguards can be reached, or where a recipient fails to respect them, Art. 5(10) authorises the data holder to suspend or withhold the sharing of trade secrets, provided that the decision is substantiated in writing and notified to the competent authority. Importantly, requests for access cannot be refused solely because the data contains trade secrets. Yet, Art. 5(11) introduces an exception: in specific circumstances, the data holder who is also the trade secret holder may refuse disclosure altogether, but only if it can demonstrate, on a case-by-case basis, that even with safeguards in place, disclosure would highly likely result in serious and irreparable economic harm. Such refusal must be grounded in objective evidence, communicated in writing to the requesting party, and notified to the competent authority.

This regime raises important questions about the compatibility between trade secret protection and the Data Act's ambition to enhance the circular economy. The scope of the Data Act is already limited, as it only applies to IoT data – and within this framework, the interplay with trade secret protection introduces further legal ambiguity.[48] For example, raw data is generally excluded from trade secret protection[49] and is therefore freely shareable under the Data Act; inferred data is expressly exempted from access obligations and thus never shareable (Recital 15); while pre-processed data clearly falls within the scope of the Data Act (Recital 15) and may simultaneously qualify as a trade secret where the conditions for protection are met. Processed data, however, is left unaddressed, creating a grey zone.

The uncertainty is compounded by the safeguard clause in Art. 5(11), which allows data holders to refuse access where disclosure would risk serious economic harm. In the absence of precise thresholds or interpretative guidance, this provision risks functioning as a broad exception, potentially undermining the enforceability of access rights and encouraging defensive refusals. The burden of contesting such claims then shifts to users – often SMEs or independent repairers – who may lack the legal or technical capacity to rebut assertions of risk or to implement adequate confidentiality measures.

At the root of this tension lies a divergence in the treatment of data across legal instruments. The Trade Secrets Directive (Art. 2(1)) defines a trade secret broadly, as information that is secret, commercially valuable because of that secrecy, and subject to reasonable steps to preserve its confidentiality. This definition may cover anything from technical know-how to customer lists. By contrast, the Data Act narrows its scope to data generated by connected devices, including raw and pre-processed data, while excluding inferred or derived data. Yet data exists along a

[48] *See*, *ex multis*, Sousa e Silva (2014).

[49] Drexl (2017); Aplin et al. (2023); Mylly (2024).

continuum – from raw to inferred – and the conceptual boundaries between these categories remain blurred. This is particularly problematic for processed data, which are critical to circular practices. Such data may be protected as trade secrets while simultaneously falling into an unclear position under the Data Act's access obligations. An important interpretative element emerges from Recital 15 itself, which appears to justify the exclusion of derived and inferred data on the grounds that it results from "additional investments into assigning values or insights from the data." From this, it can be elicited that the *added value* generated through such processing should not be subject to mandatory sharing obligations, as imposing disclosure could risk disincentivising what is often referred to as the "inference economy."[50]

The paradox, however, is acute: the more value added through data processing, the greater the likelihood that the resulting information qualifies as a trade secret and, at the same time, falls outside the scope of mandatory sharing because it is classified as derived or inferred. The very attributes that make data most useful for circularity – its precision, reliability, and embedded know-how – thus risk becoming the basis for its legal exclusion from access obligations under the Data Act.

Finally, the potential for divergent national implementation of both the Trade Secrets Directive and the Data Act magnifies legal uncertainty. Member States may adopt varying interpretations of key concepts such as "serious economic harm," "reasonable steps" to preserve secrecy, or the proportionality of disclosure. Such divergences could lead to fragmentation within the internal market, undermining the uniform application of the Data Act and reducing its effectiveness in enabling cross-border circular business models.

Similar tensions emerge under the ESPR. For example, DPPs are intended to collect and transmit structured, interoperable information about a product's composition, origin, and environmental footprint across its lifecycle. In principle, they exemplify the potential of data-driven instruments to embed circularity into product design and value chains. If effectively implemented, DPPs could facilitate repair, remanufacturing, recycling, and responsible consumption by ensuring that relevant information flows seamlessly among producers, regulators, and downstream users.

Yet the promise of the DPP is tempered by significant regulatory indeterminacy. While the ESPR mandates the creation of DPPs, it simultaneously incorporates broad protections for intellectual property and trade secrets. Recital 33 refers to "differentiated access by design" as a possible solution to the tension between transparency and confidentiality, but fails to provide a clear operational framework. Recital 74 anticipates further specifications for digital documentation, yet stops short of resolving the normative dilemmas raised by the interaction between openness and proprietary interests. In practice, this leaves manufacturers with wide discretion over what information is disclosed, to whom, and under what conditions – potentially undermining the DPP's role as a vehicle for systemic transparency.

This ambiguity reinforces the structural misalignment already identified in the context of the Data Act: while the EU's data strategy promotes access, interoperability, and aftermarket use, it concurrently allows firms to restrict

[50] On the value of inferred data and of the inference economy, *see* Pybus and Coté (2021).

disclosure by invoking broadly defined commercial harms. In the case of the DPP, this results in a disjunction between the rhetoric of empowerment and the reality of persistent information asymmetries – particularly disadvantaging independent repairers, circular innovators, and other non-dominant market actors. Trade secret protections can thus be strategically mobilised to shield critical product information from disclosure, even where such information is indispensable for ecological objectives.

Proposals to address this tension often focus on tiered-access models.[51] These would distinguish between a public-facing DPP – providing essential sustainability-related information such as repairability, durability, and recyclability – and a restricted-access layer containing commercially sensitive data, accessible only to authorised actors (e.g. regulators or certified repairers) under confidentiality safeguards. Technological enablers such as encryption, secure access protocols, and blockchain-based traceability are frequently cited as tools to manage such differentiated access.

However, while technologically feasible, these solutions cannot resolve the underlying legal and institutional uncertainty. In the absence of a coherent regulatory framework governing access rights, eligibility criteria, and enforcement mechanisms, tiered-access models risk introducing additional layers of complexity and compliance burdens – particularly for smaller actors – without clarifying the fundamental questions of what must be disclosed, to whom, and under which conditions. The reliance on technical architectures without normative clarity risks obscuring the fact that the core problem is not technological, but juridical and structural.

The fragility of the DPP thus exposes a broader governance deficit. The EU's data circularity framework remains fragmented across multiple legal instruments which, despite their overlapping aims, are only partially integrated. As long as this legal ecosystem lacks a unified normative vision for reconciling openness with the legitimate protection of commercial interests, the transformative potential of the DPP will remain unrealised. Instead of enabling circularity, the DPP risks functioning as a symbolic instrument – signalling transparency while operating within a regime that continues to entrench opacity.

6 Conclusion

IPRs and data governance must be reconceptualized as mutually reinforcing pillars of a legal framework capable of sustaining circularity. Today's regimes remain overly anchored in exclusivity and proprietary control, privileging private economic interests over systemic goals such as openness and collaboration – that are in turn needed for the achievement of the circular economy. This imbalance inhibits the development of circular business models and slows the transition toward a genuinely resource-efficient system. Realizing the full potential of circularity therefore requires a comprehensive, public-interest-oriented reform agenda – one

[51] *See* Voulgaridis et al. (2024).

that reconfigures both IPRs and data governance to advance environmental and societal objectives alongside economic and technological progress.

Accordingly, alignment between data governance reforms and a deep rethinking of IPRs is essential. On the IPR side, this means a substantive restructuring of the system, particularly trade secrets, in light of the growing centrality of data. The recent EU legislative initiatives represent meaningful steps toward embedding circularity within the legal order. Nevertheless, significant barriers persist – most notably around data access and the capacity of IP frameworks to support openness and interoperability. These constraints reflect the entrenched orientation of trade secret law toward exclusivity and market-based incentives, often to the detriment of environmental and public interests. If the EU is to truly facilitate circular innovation, IPRs must be reimagined as tools for fostering collaborative, sustainability-oriented ecosystems. This entails not only doctrinal adaptation but also structural realignment to ensure they support environmental resilience and social well-being alongside economic growth. In this context, trade secret law – arguably the most opaque IPR – requires urgent reconsideration. While protection remains a legitimate incentive for innovation and investment,[52] overly broad or indefinite secrecy obstructs the transparency and knowledge flows essential to circular practice. Mechanisms such as time-limited protection or conditional disclosure obligations should therefore be explored, with the overarching objective of striking an equitable balance: incentivizing innovation without impeding ecological and collaborative goals.

On the data governance side, it is equally vital to avoid replicating the proprietary logic that has historically underpinned IPRs. A model premised on exclusive control and commodification is fundamentally incompatible with the principles of circularity, where transparency, interoperability, and open access are essential. Current policy trajectories – including the Data Act – still frame data primarily as an economic asset rather than critical infrastructure for sustainable development. Without a paradigm shift that foregrounds public value, data governance risks reproducing the same limitations that constrain IP law, thereby stifling innovation and obstructing sharing. Instead, data governance must be restructured to prioritize public value over market exclusivity. This includes establishing EU-wide sectoral data spaces and open platforms designed to enable circular services, and ensuring transparency in material flows to foster both regulatory compliance and the operational viability of circular models. Crucially, these institutional reforms must be accompanied by a cultural shift: data must be reconceptualized as a public good – integral to sustainability, economic resilience, and social equity – rather than as a tradable commodity. Case studies such as open-source hardware initiatives[53] and repair-oriented companies like Fairphone demonstrate that data transparency and business viability are not mutually exclusive, but mutually reinforcing.

Finally, above all, the ecological imperative at the heart of the circular economy must take precedence over private secrecy interests. At present, the Data Act's exception for trade secret disclosure is limited to avoiding significant economic

[52] Searle (2021); First (2012).

[53] Stange and Ihlenfeldt (2025).

harm and sets out only the procedure for invoking the exception. Competent authorities therefore assess merely these conditions. What is missing is a second step: balancing the relevance of the protected data against its character as circular data – that is, information indispensable to enabling circular practices and business models. A coherent framework must thus require a two-step evaluation: first, establishing whether the exception applies, and second, weighing private interests against the public interest in environmental protection.

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