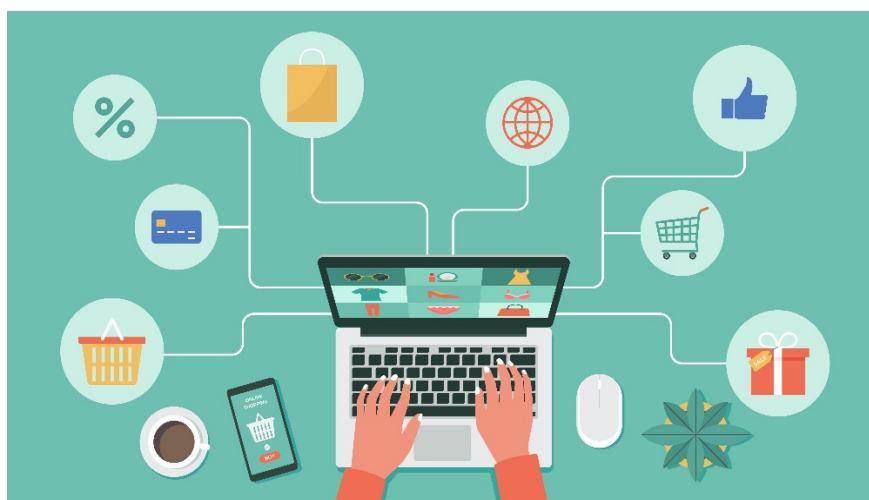


E-commerce and the EU Green Deal

Analysis of the environmental
footprint of online sales in the
context of the circular economy



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Abstract

The rise of online sales and marketplaces poses new challenges to product safety, consumer protection, and unfair business practices. At the same time, e-commerce has the potential to facilitate more sustainable production processes and consumption patterns and ensure more circularity. This study provides information on the role of e-commerce in implementing the European Green Deal and makes recommendations for future action.

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This document was requested by the European Parliament's committee on Internal Market and Consumer Protection (IMCO).

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LIST OF ABBREVIATIONS

ACM	Dutch Authority for Consumer and Markets
ADCO	An Administrative Cooperation Group
ADEME	l'Agence De l'Environnement Et De La Maitrise De l'Energie
APASS	Amazon's Packaging Support and Supplier Network
B2C	Business To Customers
BEUC	Bureau Européen Des Unions De Consommateur
C2C	Customer To Customer
CMA	Competition And Markets Authority
CO₂	Carbon Dioxide
CPC	Consumer Protection Cooperation
CRD	The Consumer Rights Directive
DESI	Digital Economy and Society Index
DMA	Digital Market Act
DPP	Digital Product Passports
DSA	Digital Service Act
DUH	Deutsche Umwelthilfe
EC	European Commission
EDM	Empirical Dynamic Modelling
EEA	European Economic Area
EF	Environmental Footprint
ESG	Environmental, Social And Governance
ESPR	Ecodesign For Sustainable Products Regulation

EU	European Union
EUR	Euro
FMCG	Fast-Moving Consumer Goods
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GHG	Green House Gas
GOTS	Global Organic Textile Standards
GRI	Global Reporting Initiative
ICT	Information And Communication Technology
ISO	International Standards Organisation
JRC	Joint Research Centre
KPIs	Key Performance Indicators
LCAs	Life-Cycle Assessments
MCS	Marine Stewardship Council
MSAs	Market Surveillance Authorities
MSI	Material Sustainability Index (MSI)
NFRD	Non-Financial Reporting Directive
ODR	Online Dispute Resolution
OEF	Organizational Environmental Footprint
OEFSRs	Organizational Environmental Footprint Sector Rules
OEM	Original Equipment Manufacturer
O-LCA	On Organizational-Level Life-Cycle Assessments
PEF	Product Environmental Footprints

PEFCRs	Product Environment Footprint Category Rules
P-LCA	Product-Level Life-Cycle Assessments
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SAC	Sustainable Apparel Coalition
SMEs	Small and Medium Sized Enterprises
UCPD	Unfair Commercial Practices Directive
UCTD	Unfair Contract Terms Directive
UK	United Kingdom
US	United States
USD	United States Dollars
VSS	Voluntary Sustainability Standards
WEEE Directive	Waste Electrical And Electronic Equipment Directive

EXECUTIVE SUMMARY

With the growth of e-commerce in the EU, both in absolute terms and relative to traditional retail, it becomes ever-more important to ensure that e-commerce is compatible with EU sustainability objectives and that a high level of consumer protection is maintained in Europe.

The objective of this study was to provide information on the role of e-commerce in implementing the EU Green Deal in the context of the circular economy. In particular, this study aims to:

- Analyse how to uphold high consumer protection standards with online sales in the internal market while using digitisation;
- Investigate the environmental footprint of e-commerce;
- Assess the role that e-commerce plays or could potentially play in implementing the EU Green Deal's goals; and
- Design tailored policy recommendations to tackle the issues identified.

The study is based on an extensive review of literature, complemented by expert advice. Targeted desk research was also performed on a sample of e-retailers, platforms and online marketplaces and interviews with online retailers, civil society, and consumer protection organisations, as well as large online platforms.

The rise of online sales and marketplaces poses specific issues for consumer protection around information provision and personalisation.

The relative importance of e-commerce, in comparison to purchases from traditional brick-and-mortar stores, is steadily growing throughout Europe, both in terms of total revenue and in terms of the share of the EU public with access to online retail. **The rise of domestic and cross-border e-commerce has highlighted specific consumer issues in the online space.**

The most prominent unfair practices discussed in the literature in relation to e-commerce concern information provision to consumers, including:

- Which information is provided to consumers;
- Personalisation practices used; and
- How information is presented to consumers.

When it comes to the **type of information provided in e-commerce transactions, the main concerns stem from misleading and unfair practices**. Examples include the omission of important information on the product or service, lack of price transparency, or misleading information to influence consumer decision making.

With rising interest in the climate change, consumers have become more interested in sustainable consumption choices. While some traders have responded to this trend by offering more eco-friendly and sustainable choices, others have used misleading sustainability claims as an advertising strategy (i.e. greenwashing).

When it comes to the **way information is provided, interface design has become a powerful tool that traders can use as part of their market practices**. Using interface design to coerce, steer or deceive users into making unintended and potentially harmful choices is known as 'dark patterns'. In recent years, behavioural scientists have also emphasised that, in the digital environment, it is more important to define *how*, not *what* information is presented.

Finally, in recent years, there has been an **increase in consumer issues stemming from various personalisation practices**. Increased use of online platforms and technological developments have enabled traders to collect vast amounts of personal information on consumers. Targeted advertising has become a large and growing market due to more frequent use of big data in online environments. This has led to a new generation of unfair practices which often involve a combination of personalised practices and dark patterns that are even more difficult for both consumers and authorities to recognize.

In addition to the specific characteristics of e-commerce, reliable information about environmental footprint is lacking.

While specific features characterise e-commerce business models, more recently, the dichotomy between online and offline retail commerce has become increasingly blurred, and the environmental footprints of these two business models are becoming intertwined.

At the same time, differences remain for product delivery and returns. Different kinds of e-commerce businesses lend themselves to different forms of sustainability innovation. The opportunities for innovation differ especially between businesses that sell services, including online services, versus those that primarily sell physical goods.

Currently, **there is no single approach that is systematically applied to capture the total environmental footprint of e-commerce fully**. There are, however, different approaches to arrive at a partial assessment of the impact of e-commerce merchants and the products and services sold online.

Three overarching categories of approaches are identified. The approaches are not mutually exclusive, and they can, at times, overlap due to underlying similarities in methodologies:

- Academia and the scientific community mainly compare the environmental footprint from different retail channels (traditional vs online or hybrids), with an almost exclusive focus on logistics and distribution;
- The scientific community and policy makers provide approaches based on standardised methodologies such as official standards and frameworks for Environmental, Social and Governance (ESG) reporting, to be applied by industry. Those standards either focus on product or organisational life cycles or corporations' corporate (carbon) footprints; and
- Industry and the commercial sectors mainly use issue-specific approaches for easily communicable and (partially) comparable information to the consumer. This usually consists of sustainability certifications for a single issue or simplified product-level sustainability indices.

This study finds that **the majority of approaches are insufficiently sound from a scientific point of view for calculating the environmental footprint of e-commerce**. After weighing the soundness of the approach with the soundness of its application in practice, no application is found to be scientifically sound. Applications in product or organisational life cycle assessments are found to be the most sound, while the least sound applications are found within certification schemes.

At the same time, there is evidence that e-commerce has specific impacts on sustainability.

E-commerce environmental footprint currently presents hotspots, such as logistics, over-packaging, and destruction after return. Logistics and transportation of goods is one of the areas in which e-commerce has caused the greatest and most significant transformation. It is also one of the key considerations when it comes to the opportunities and threats that e-commerce presents for sustainability. The threats arising in this context predominantly involve additional CO₂ emissions

caused because of goods having to be returned, increased freight traffic to remote locations, and the great importance placed on fast delivery in e-commerce business models. At the same time, advancements in transport technology and business models which provide pick-up point options for consumers (replacing emissions created by delivering to individual homes) can help to reduce emissions.

Regarding energy usage and efficiency, a significant factor affecting the environmental footprint of e-commerce is the effect that data transfers involved in online shopping have on electricity demand. In the context of widespread internet use, the availability of information on the internet represents an opportunity as consumers can do research and select to purchase from more eco-friendly companies. E-commerce plays a role in facilitating these purchases. Without it, such consumers are restricted to physical retail options available in their vicinity, which may only involve companies with poor sustainability models.

The growth of e-commerce has meant more packaging being used inefficiently without promising solutions to reduce its impact. In particular, the main threats consist of excessive packaging and secondary packaging specific to e-commerce. As regards opportunities to mitigate the impact of packaging, efforts have been placed on increasing efficiency in packaging and developing solutions to reuse packaging.

Regarding e-commerce's impact on a product's end of life, findings suggest online platforms have allowed for the growth of the circular economy. A prime example can be found in the expansion of what is known as the 're-commerce' market or second-hand e-commerce. Similarly, e-commerce has fostered the growth of "aftermarkets" where consumers can purchase spare parts used to repair products, thereby ensuring items are not thrown out.

From a legislative perspective, there is no overarching, integrated EU policy instrument covering the sustainable production and consumption of all products nor the availability and reliability of information on these products to consumers. To date, several upcoming initiatives tackle sustainability issues. From the production side, they encompass how the product is designed and sold. While from the consumption side, they aim to change consumption patterns and increase the availability of information to consumers to enable them to make informed decisions. At the same time, when it comes to e-commerce legislation, **there are still areas of synergies that could further be exploited to ensure more sustainability and circularity regarding online sales.**

The way forward:

The combination of consumer protection issues, the impact of e-commerce on sustainability and the lack of reliable information have made it **difficult for consumers to make informed decisions about the sustainability of their purchases online.**

This study has identified four layers where European intervention could help address the challenges identified. While actions on some layers can happen in parallel (and some are already happening), the layers also build on one another, and they represent increasing levels of complexity for EU intervention.

More specifically, this study puts forward the following recommendations:

- **Ensuring that existing legislation is complied with in the digital space:** this would entail supporting national authorities in enforcing existing legislation, monitoring online practices with digital tools and providing support to businesses to comply with existing rules;
- **Improving information provision and transparency of offers to consumers to enable them to make better decisions:** in particular, harnessing digital innovation to make it easier for the consumer to access information on the sustainability of their purchase, while ensuring consumer protection;
- **Incentivising consumers and businesses to be more sustainable:** including, supporting e-commerce's role in fostering repair and reuse over replacement and fostering the emergence of independent repairer's network; and
- **Ensuring information on sustainability impacts is reliable:** this would entail harmonising the methodologies for assessing the environmental footprint of e-commerce and making sure that they are communicated to consumers in a transparent and easy way.

1. INTRODUCTION

This document is the final report for the Study on E-commerce and the EU Green Deal.

Objective

The objective of this study is to provide information on the role of E-commerce in implementing the EU Green Deal in the context of the circular economy.

In particular, this study aims to:

- Analyse how to uphold high consumer protection standards with online sales in the internal market while using digitisation;
- Investigate the environmental footprint of e-commerce;
- Assess the role that e-commerce plays or could potentially play in implementing the EU Green Deal's goals; and
- Design tailored policy recommendations to tackle the issues identified.

Scope

As this study focuses on consumer protection, the scope of the analysis is limited to e-commerce transactions that directly involve consumers, i.e. Business to Customer (B2C) and Customer to Customer (C2C) transactions.

From a methodological perspective, the study is based on an extensive review of existing literature, complemented by expert advice. Targeted desk research was also performed among a sample of e-retailers, platforms and online marketplaces and interviews with online retailers, civil society and consumer protection organisations as well as large online platforms.

The data collection aimed to draw a picture of the primary practices of different types of e-commerce retailers and to link these practices to consumer protection and sustainability in the online space.

Structure

The report is structured as follows:

- Chapter 2 provides an overview of the growing importance of e-commerce in the EU economy, the main market players who operate in this space and the specific issues for consumer protection that are generated by e-commerce, with a focus on sustainability;
- Chapter 3 analyses the environmental footprint of the e-commerce sector, including the pros and cons of different measurement approaches;
- Chapter 4 presents the opportunities and threats to sustainability generated by e-commerce both from a market and from a legal perspective; and
- Chapter 5 summarises the main conclusions from the analysis and provides tailored recommendations to foster sustainability in the e-commerce sector.

2. CONSUMER PROTECTION IN THE E-COMMERCE SECTOR

This chapter provides an overview of the growing importance of e-commerce in the EU today. It surveys the wide range of market players, sectors and business models that comprise the e-commerce business, and it identifies the key consumer protection issues that e-commerce transactions generate.

KEY FINDINGS

The rise of domestic and cross-border e-commerce has highlighted specific consumer issues in the online space.

The most prominent unfair practices discussed in the literature concerning e-commerce concern information provision to consumers.

- When it comes to the **type of information provided in e-commerce transactions, the main concerns stem from misleading and unfair practices**, such as the omission of important information on the product or service, lack of price transparency, or misleading information to influence consumer decision making;
- Regarding the **way information is provided, interface design has become a powerful tool that traders can use as part of their market practices**. Using interface design to coerce, steer or deceive users into making unintended and potentially harmful choices is known as 'dark patterns'. In recent years, behavioural scientists have also emphasised that, in the digital environment, it is more important to define *how*, not *what* information is presented; and
- Finally, in recent years, there has been an **increase in consumer issues stemming from various personalisation practices**. Targeted advertising has become a large and growing market due to more frequent use of big data in online environments. This has led to a new generation of unfair practices, which often involve a combination of personalised practices and dark patterns that are even more difficult for consumers and authorities to recognise.

2.1. E-commerce plays an increasingly important economic role in Europe

This section briefly describes the recent growth of e-commerce in Europe and its economic and social importance.

2.1.1. Total turnover from e-commerce and its share in retail sales have increased sharply in recent years

Over the last 10 years, e-commerce has consistently exhibited very high growth rates. The e-commerce share of the turnover of all EU-27 enterprises (except financial) increased from 13% in 2010 to 18% in 2019 before jumping to 20% in 2020 and 2021¹. A clear uptick in the use of e-commerce is visible in most if not all EU countries².

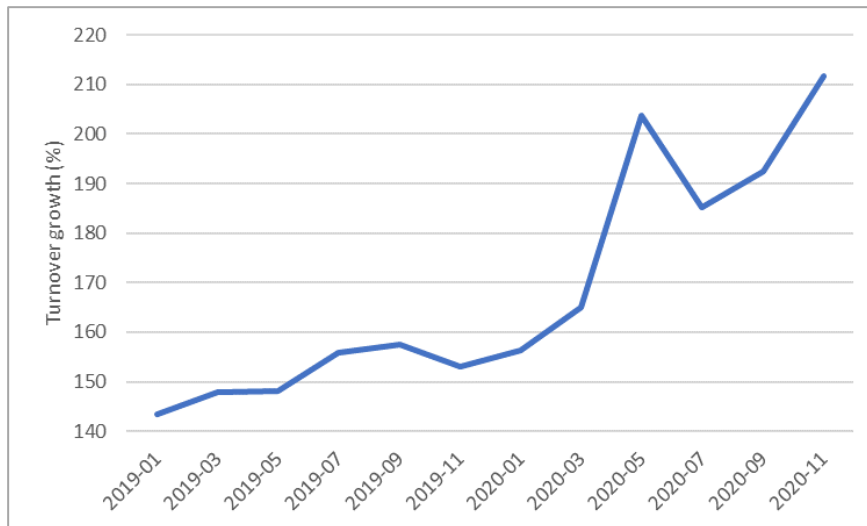
This evolution has accelerated even further with the covid-19 pandemic. A large section of EU retail shifted from physical stores to online, as a consequence not only of movement restrictions

¹ Eurostat, 2022, Share of enterprises' turnover on e-commerce - %, [Indicator: TIN00110]. Available at: <https://ec.europa.eu/eurostat/databrowser/view/tin00110/default/table?lang=en>.

² Lone, S., Harboul, N. & Weltevreden, J.W.J., 2021, *2021 European E-commerce Report*, Amsterdam University of Applied Sciences & Ecommerce Europe, Amsterdam/Brussels. Available at: [European E-Commerce Report 2021 - EuroCommerce](#).

related to the pandemic but also of voluntary distancing to avoid contagion^{3,4} Figure 1 shows how the growth in online and mail orders mirrors the evolution of the pandemic with a rapid rise between March and May 2020, a dip in the July 2020 and a subsequent return by November 2020 to levels similar to those of May 2020⁵.

Figure 1: Growth in retail turnover via Internet or via mail order houses (January 2019 – November 2020; 2015 = 100)



Source: Eurostat, online data code: STS_TRTU_M; 2015=100, seasonally adjusted monthly data excluding motor vehicles and motorcycles.

In addition to the absolute growth of e-commerce, its relative importance, compared to purchases from traditional brick-and-mortar stores, is also steadily growing throughout Europe.

For instance, e-Commerce Europe estimates that the share of e-commerce in the EU-27 Gross Domestic Product (GDP) rose from 2.53% to 3.99% between 2017 and 2021⁶. According to Eurostat, the total turnover share from e-commerce sales in the EU increased steadily from 13% in 2013 to 20% in 2020⁷. The Member States where enterprises had the highest total turnover share from e-commerce sales were Ireland (38%), Czechia (30%), Belgium and Denmark (28% each). In comparison, the lowest share can be found in Cyprus (4%), Bulgaria (6%), and Romania (9%)⁸.

³ Marcus, J. S., Pelkmans, J., Röhner, N., Poitiers, N., Jenrenaud, L., Monika, & Buckingham, S. 2021, The impact of COVID-19 on the Internal Market Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg. Available at: <https://www.bruegel.org/2021/03/the-impact-of-covid-19-on-the-internal-market/>.

⁴ Ibid.

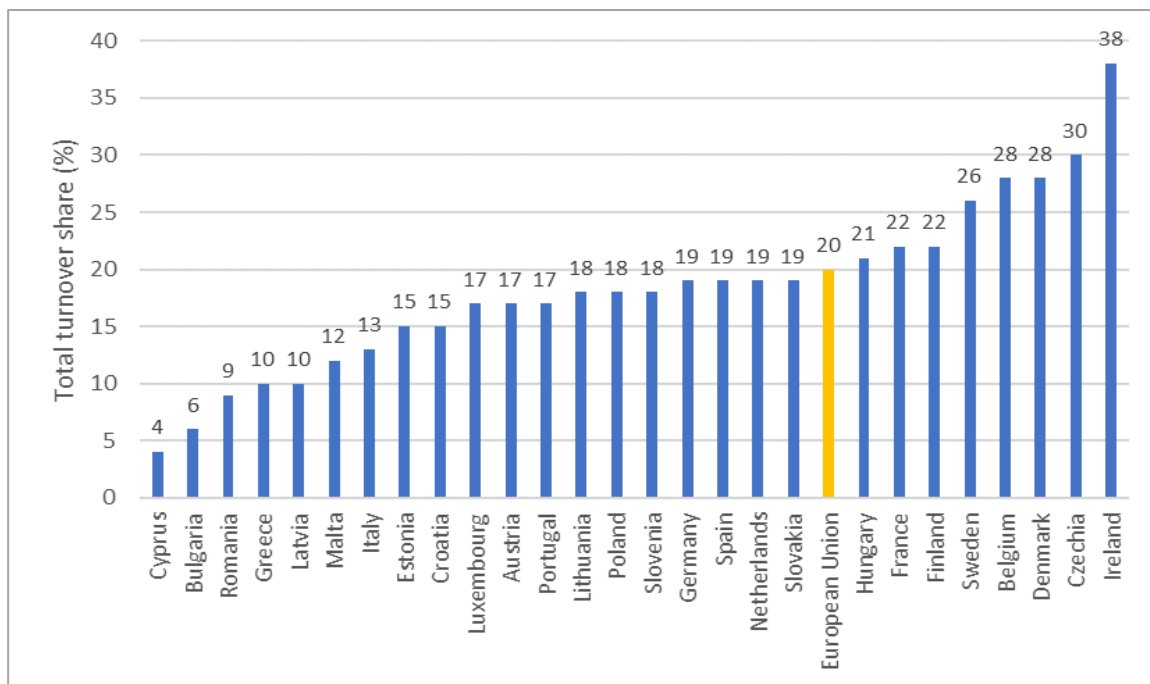
⁵ E-Commerce Europe, 2021, Europe E-Commerce Report 2021, Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/09/2021-European-E-commerce-Report-LIGHT-VERSION.pdf>.

⁶ Lone, S., Harboul, N. & Weltevreden, J.W.J., 2021, 2021, *European E-commerce Report*, Amsterdam University of Applied Sciences & Ecommerce Europe, Amsterdam/Brussels. Available at: <https://www.eurocommerce.eu/european-e-commerce-report-2021/>.

⁷ Eurostat, 2022, *E-commerce sales*. Indicator: ISOC_EC_ESELN2. Available at: [Statistics | Eurostat \(europa.eu\)](https://statistics.eurostat.eu).

⁸ Ibid.

Figure 2: Enterprises' total turnover share (%) from e-commerce sales in the EU Member States (2021)

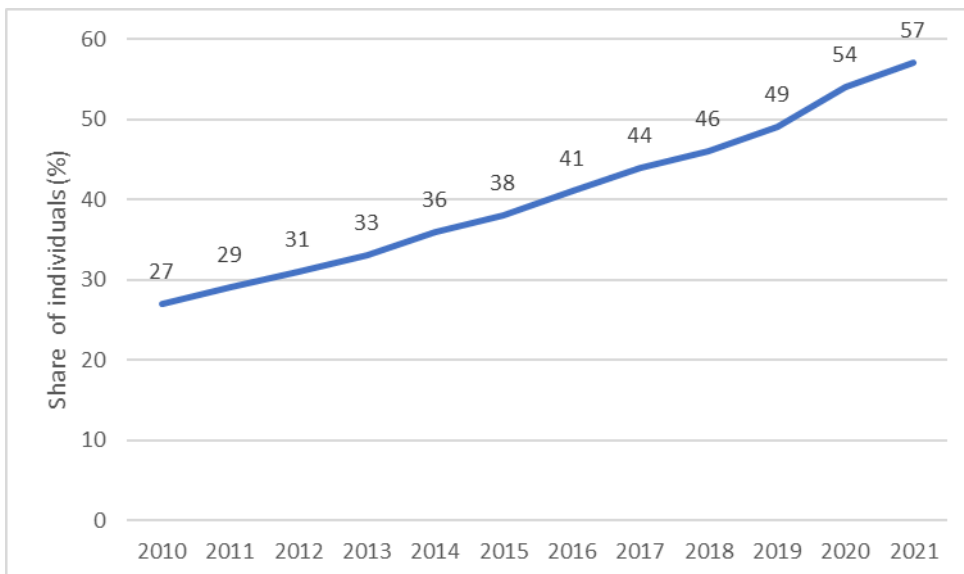


Source: Eurostat.

2.1.2. The growth of e-commerce in Europe crosses social and geographic boundaries

The share of individuals purchasing products online has more than doubled between 2010 and 2021 from 27% to 57%⁹ (see figure below)

Figure 3: Share of individuals with an online purchase in the last 3 months (EU 27, %)

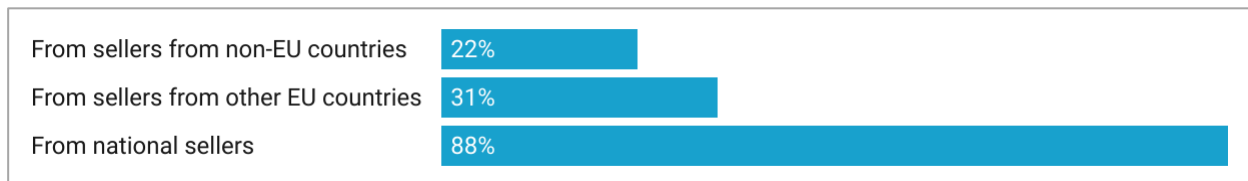


Source: Eurostat.

⁹ Eurostat, 2022, *Internet purchases by individuals*. Indicators: [isoc_ec_ibuy] and [isoc_ec_ib20]. Available at: [Statistics | Eurostat \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&plugin=1) and [Statistics | Eurostat \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&plugin=1).

In addition, many consumers have purchased goods or services from traders located in other countries. Almost one-third of all EU consumers shopping online have purchased a product from a trader in another EU country, and around 22% made a purchase from sellers in a non-EU country¹⁰.

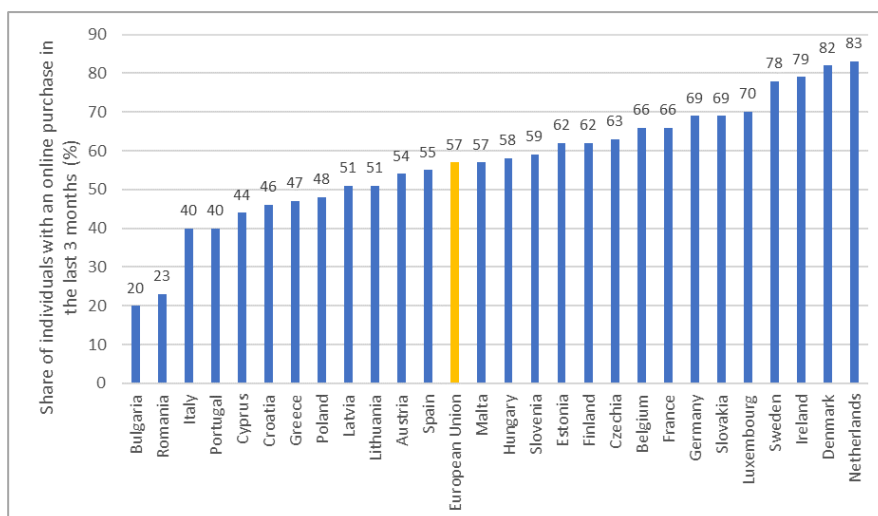
Figure 4: Share of individuals who made domestic and cross-border online purchases (EU and non-EU) in the European Union (EU-27) in 2020



Source: Statista.

Nevertheless, the difference between the EU Member States is significant. In 2021, more than 80% of the individuals in the Netherlands and Denmark purchased a product or a service online in the previous 3 months, compared with less than a quarter of individuals in Bulgaria and Romania¹¹.

Figure 5: Share of individuals with an online purchase in the last 3 months in the EU Member States (2021)



Source: Eurostat.

2.2. E-commerce covers many types of players, markets, and business models with different sustainability considerations

The e-commerce sector comprises a heterogeneous set of markets, key players, and business models. Over recent years, sustainability considerations have grown in importance across the sector.

2.2.1. Online purchases are most prevalent in the clothing and food sectors

E-commerce plays a different role across all of the traditional markets in Europe. Clothing is by far the most popular product among online purchases (39% of online buyers), followed by films or series streamed online (18%), food purchased online and delivered, and furniture (18% each) (see Figure 6).

¹⁰ Statista, 2020, *Share of individuals who made domestic and cross-border online purchases (EU and non-EU) in the European Union (EU-27) in 2020*. Available at: <https://www.statista.com/statistics/1239845/domestic-and-cross-border-purchases-eu/>.

¹¹ Ibid.

Figure 6: Share of products purchased online (EU, 2021)



Source: Eurostat.

The prevalence of e-commerce in the fashion industry is related to convenient return policies¹² and low digital barriers to entry for clothing merchants offering the opportunity to market, sell, and fulfil orders globally and automatically¹³. As a result, in Europe, it is expected that by 2025, each consumer will spend 1000 EUR on online fashion-related items over a year¹⁴.

At the same time, over the next five years, other sectors, such as grocery and personal care, are predicted to experience the most significant rises in online market growth¹⁵. For instance, online grocery sales grew by 21% in Germany and 8% in France and online beauty and personal care sales grew by 15% in both Germany and France between 2017 and 2019¹⁶. This growth is expected to continue as customer-facing technologies continue to evolve.

¹² Heycarson, 2019, *Which products do people buy online the most?*. Available at: <https://www.heycarson.com/blog/which-products-do-people-buy-online-the-most/>.

¹³ Orendorff, A., Dopson E., 2022, *The State of the Ecommerce Fashion Industry: Statistics, Trends & Strategies to Use in 2022*. Available at: <https://www.shopify.com/enterprise/ecommerce-fashion-industry>.

¹⁴ Statista, 2022, *Average retail e-commerce revenue per user in Europe from 2017 to 2025*. Available at: <https://www.statista.com/forecasts/715690/e-commerce-arpu-in-europe>.

¹⁵ Ibid.

¹⁶ Ibid.

2.2.2. There is a wide range of different e-commerce business models

The literature distinguishes between **three types of merchants in e-commerce**:

1. **Brands** that sell directly to consumers using their website (e.g. Apple, IKEA, Samsung, etc)
2. **Online retailers** who sell a wide range of products from different brands (e.g. online supermarkets, discount shops, and other retailers)
3. **Online marketplaces** which provide a variety of services to retailers and/or brands, including marketing, payment processing or similar.

There is no single metric to compare the relative size of these business models, partly because they evolve rapidly over time and because data are not available at the level of business models.

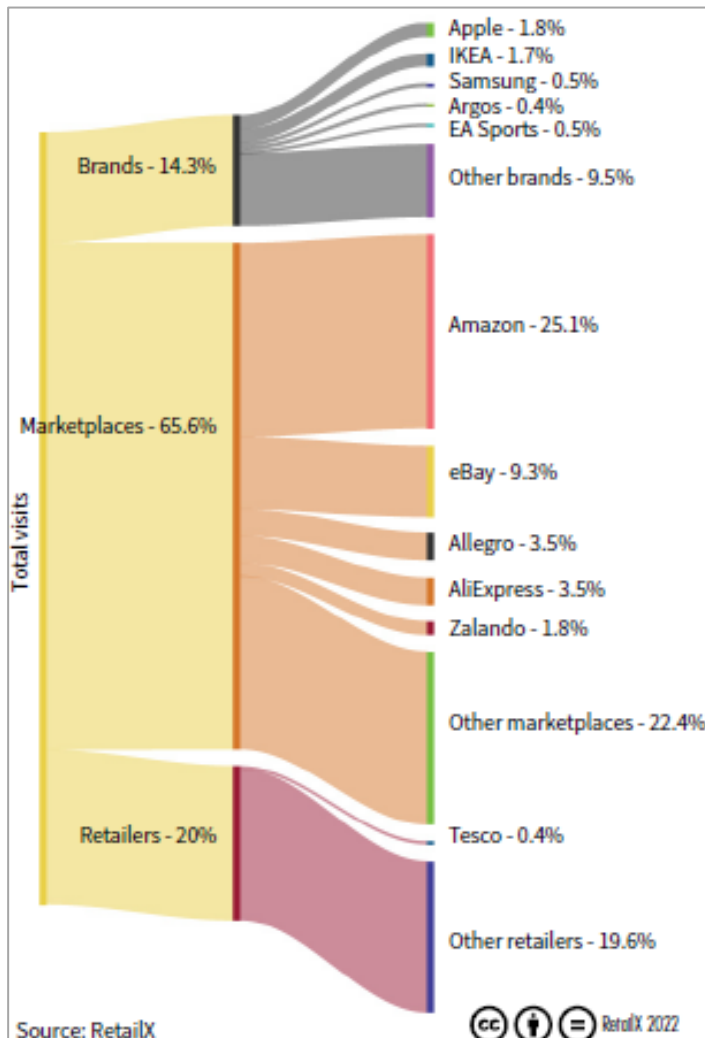
However, the figure below shows that online marketplaces constitute almost two thirds of EU consumer visits to the top 1000 websites, compared with 20% for retailers and only 14.3% for brands. Hence, the role of online marketplaces is of particular relevance when it comes to consumer protection. This is all the more important because such marketplaces are one of the key reasons for the shift toward cross-border selling and they often have their headquarters outside the EU.

Indeed, the top-ranked online marketplaces include EU companies such as Allegro in Poland and Zalando in several EU countries, non-EU marketplaces such as Amazon, eBay, Wish, and Alibaba/Aliexpress play an important role¹⁷. These marketplaces are an important tool for small and medium-sized e-retailers to expand internationally, as they can support payment processes, local marketing activities and logistical processes, including by offering fulfilment services aimed at, e.g. reducing delivery times¹⁸.

¹⁷ Ibid.

¹⁸ European Commission, 2019, *Study on the development of cross-border e-commerce through parcel delivery*, European Commission, Brussels. Available at: <https://op.europa.eu/en/publication-detail/-/publication/3fd47ff1-574d-11e9-a8ed-01aa75ed71a1/language-en>.

Figure 7: Percentage of EU consumer visits to the top 1000 websites



Source: RetailX.

Of course, these three types of online merchants also differ in terms of what they sell (goods or services), at what stage of the consumer journey they intervene (matching demand and supply, taking and/or processing payment, delivery, return, etc) and how they monetise their activity.

For instance, most online merchants involved in the delivery of goods raise revenues through direct sales and a small minority through a subscription model. Many providers of online services rely primarily on a subscription model, while those acting as intermediaries tend to earn revenues through a transaction fee or advertising model.

Finally, the business activities of each of these players also have different implications for sustainability:

- Online retailers and marketplaces whose business model centres around providing physical goods to consumers face challenges regarding the delivery and return of goods, their packaging, and the products' sustainability.
- By contrast, online retailers and marketplaces whose main business is to deliver services such as media content need to concern themselves greatly with the energy efficiency of their data centres. Still, they are not subject to the same kind of sustainability challenges regarding delivery or packaging.

- Other platforms only act as intermediaries in exchanging goods or services between consumers and are thus referred to as C2C firms. While goods or services are still being exchanged, the platform does not participate in this¹⁹. The key sustainability implication in these cases lies in the nature of the good or service itself and how the buyer uses it.

The table below presents a taxonomy of e-commerce merchants differentiating the type of service, the sector (goods/services), the role of the platform in the transaction (B2C/C2C) and the opportunities for innovation to foster sustainability.

Table 1: A taxonomy of e-commerce in services and goods

What is offered	B2C/C2C	Key sustainability consideration	Example firms
Services			
Audio and video streaming	B2C	Renewable energy for data centres	Netflix, Amazon Prime, Disney, Spotify
Sharing of asset (residence, vehicle or good)	C2C	Re-use/refurbish/resell returned asset	AirBnB, BlaBlaCar
Referral to other commercial services	B2C	Renewable energy for data centres	Google, Facebook
Sale of used goods	B2C, C2C	Reduced transport costs Re-use/refurbish/resell returned goods Renewable energy for data centres	E-Bay, Amazon
Goods			
Groceries	B2C	Improve packaging Reduce transport costs More efficient production of goods More sustainable disposal of goods	Amazon, most French large grocery stores, e.g. Carrefour

¹⁹ At the intersection of these two models, certain e-commerce platforms act as intermediaries between business that manufacture and deliver goods and consumers, the business to business to consumer (B2B2C) segment of the market. In the subsequent discussion, it will be assumed that these platforms fall under the first category, that of delivering physical goods. Platforms dedicated to the delivery of services will also not be discussed.

What is offered	B2C/C2C	Key sustainability consideration	Example firms
Beauty and personal care	B2C	Improve packaging Reduce transport costs More efficient production of goods More sustainable disposal of goods	Amazon, bol.com
Living and furnishing	B2C	Improve packaging Reduce transport costs More efficient production of goods More sustainable disposal of goods	Amazon, Ikea, Otto
Hobby and leisure	B2C	Improve packaging Reduce transport costs More efficient production of goods More sustainable disposal of goods	Amazon
Electronics	B2C	Improve packaging Reduce transport costs More efficient production of goods More sustainable disposal of goods	Amazon, Coolblue
Fashion and accessories	B2C	Improve packaging Reduce transport costs More efficient production of goods More sustainable disposal of goods	Amazon, Zalando

Source: Bruegel.

2.3. The rise of e-commerce has generated specific consumer protection concerns

The rise of domestic and cross-border e-commerce described in Sections 2.1 and 2.2 has drawn attention to specific consumer issues in the online space. In general, consumers have limited knowledge about which unfair practices exist in digital environments²⁰. Furthermore, many consumers are not aware of their rights to begin with. The Consumer Conditions Scorecard indicates that more than one fifth of EU consumers feel unsure about their rights. An additional 20% reported that they do not know how to submit a complaint when they experience a problem with a seller²¹.

In online environments, unfair practices discussed in the literature generally concern transparency and information provision to consumers, including:

- Which information is provided to consumers;
- How offers to consumers are personalised; and
- How information is presented to consumers.

2.3.1. The type of information provided in e-commerce transactions can lead to consumer protection concerns

EU consumer law, including the Consumer Rights Directive (CRD), Unfair Contract Terms Directive (UCTD), and Unfair Commercial Practices Directive (UCPD) to name a few, contain clear obligations for traders on which information needs to be provided to consumers both at the pre-contractual and contractual stage in the consumer journey.

However, a Consumer Protection Cooperation (CPC) sweep²² conducted in 2019 discovered many instances in which traders omitted important information from consumers. The sweep included 481 websites selling products online and revealed that approximately two thirds of the websites might be infringing EU law:

- More than 25% did not inform consumers of the 14-day right to withdrawal;
- One third did not inform consumers that they were entitled to a 2-year guarantee to have a good repaired, replaced or reimbursed in case it was faulty at the moment of delivery; and
- Around 45% did not provide a link to the Online Dispute Resolution platform.

Since EU legislation contains a comprehensive list of information which must be provided to consumers, some traders use more subtle practices to influence consumers, such as providing misleading information (e.g., hidden advertising, fake reviews, etc.). For instance, when it comes to reviews, consumers increasingly consult online customer reviews before making a purchase²³ and they trust customer reviews more than information provided by the seller²⁴ which has led some traders to provide fake customer reviews to promote their products. To investigate this issue, the CPC network

²⁰ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*, Brussels. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

²¹ European Commission, 2019, *Consumer Conditions Scoreboard 2019*, Brussels. Available at: https://ec.europa.eu/info/sites/default/files/consumers-conditions-scoreboard-2019_pdf_en.pdf.

²² Wigand, C., and Mercier, G., 2020, *Online shopping: Commission and Consumer Protection authorities urge traders to bring information policy in line with EU law*, European Commission, Brussels. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_20_156.

²³ Martínez Otero, J. M., 2021, *Fake reviews on online platforms: perspectives from the US, UK and EU legislations*. SN Social Sciences, 1(7), 1-30. Available at: <https://doi.org/10.1007/s43545-021-00193-8>.

²⁴ Short, K. L., 2012, *Buy my vote: online reviews for sale*. Vand. J. Ent. & Tech. L., 15, 441.

conducted a sweep in 2021²⁵ which included 223 websites from 26 Member States, Iceland and Norway. They concluded that:

- 55% of checked websites were infringing the obligations set out in the UCPD and they had doubts about an additional 18% of websites;
- In the worst-case scenario, this would imply that over two thirds of traders use hidden advertising/fake customer reviews; and
- It is very difficult for both authorities and consumers to recognise fake reviews, which can become a major obstacle in enforcing consumer rights.

Lack of price transparency is another strategy some traders use to influence consumer decision-making. A CPC sweep of online shopping websites²⁶ found that one fifth of traders did not display the complete price of products, often omitting additional costs such as delivery or postal charges. Other common strategies identified in the literature include dynamic pricing and personalised pricing, which varies depending on past consumer behaviour, location and the user device. These practices rely on personal data, and there is evidence that traders do not always inform consumers about the use of such data and do not explain how prices are calculated²⁷. There is no consensus among stakeholders whether these pricing methods improve user experiences or whether they constitute a manipulation²⁸. At the same time, it is clear that consumers do not always know how dynamic pricing or price personalisation is applied, whether it is to their advantage. They do not have the option to refuse this practice²⁹.

Providing misleading information may also lead to consumers having difficulty understanding who the transactional parties are. In many online marketplaces, the exact identity of the seller is unclear, especially when platforms offer their own products alongside other sellers. However, this is vital information in the context of consumer rights. For example, an issue may occur when consumers are not explicitly informed whether the ordered product is being delivered from a seller located in the EU, European Economic Area (EEA) or third countries³⁰. This can be especially detrimental if the location of the seller (e.g., outside the EU) implies additional charges or involves more complicated return policies. Consumers may not know whether they are buying from an entrepreneur, an overlay service, a platform or some other actor³¹. In such cases, consumers may confuse obligations stemming from different contracts (e.g., the sales contract and the contract on the platform usage). On top of this, consumers may assume that the location of the seller and of the marketplace is the same and realise

²⁵ European Commission, 2021, *Sweeps*, Brussels. Available at: https://ec.europa.eu/info/live-work-travel-eu/consumer-rights-and-complaints/enforcement-consumer-protection/sweeps_en#2021-sweep-on-online-consumer-reviews.

²⁶ Wigand, C., and Mercier, G., 2020, *Online shopping: Commission and Consumer Protection authorities urge traders to bring information policy in line with EU law*, European Commission, Brussels. Available at: https://ec.europa.eu/commission/presscorner/detail/en/IP_20_156.

²⁷ Verbraucherzentrale, 2019, *Individualisierte Preisdifferenzierung im deutschen Online-Handel: Eine Untersuchung der Verbraucherzentralen – November 2018*. Available at: <https://www.verbraucherzentrale.de/sites/default/files/2019-09/marktwaechter-untersuchung-individualisierte-preisdifferenzierung.pdf>; Verbraucherzentral (2019). *Dynamische Preisdifferenzierung im deutschen Online-Handel*, Available at: <https://www.verbraucherzentrale.de/marktbeobachtung/dynamische-preisdifferenzierung-im-deutschen-onlinehandel-40212>.

²⁸ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

²⁹ Ipsos, London Economics and Deloitte, 2018, *Consumer market study on online market segmentation through personalised pricing/offers in the European Union*. Available at: https://ec.europa.eu/info/publications/consumer-market-study-online-market-segmentation-through-personalised-pricing-offers-european-union_en.

³⁰ BEUC, 2019, *WTO e-commerce negotiations: BEUC recommendations*. Available at: https://www.beuc.eu/publications/beuc-x-2019-014_wto_e-commerce_negotiations_-_beuc_recommendations.pdf.

³¹ See the detailed explanations and examples given in Riefa, Ch., 2019, *Consumer Protection on Social Media Platforms: Tackling the Challenges of Social Commerce*, Available at: <https://ssrn.com/abstract=3373704>.

their mistake only at the very end of the ordering process, or – in the worst case – when the order is delivered³².

Concerning the Green Deal, rising interest in the climate change has led some traders to use misleading sustainability claims as an advertising strategy (greenwashing). For instance, the CPC Network discovered that the credibility of almost half of the sustainability claims they reviewed were doubtful³³. In many cases (around 60%), the authorities concluded that traders did not provide enough information which would allow them to assess the accuracy of the claims. This is confirmed by the fact that 61% of consumers in the EU find it hard to know which products are really green³⁴. Such lack of information and transparency can undermine trust in legitimate sustainability claims and put some consumers off trying to make more sustainable choices.

2.3.3. The way information is provided in e-commerce transactions can lead to consumer protection concerns

With the rise of the platform economy, interface design has become a powerful tool traders can use as part of their market practices. Using interface design to coerce, steer or deceive users into making unintended and potentially harmful designs is known as dark patterns³⁵. In recent years, behavioural scientists have also emphasised that it is more important to define how, not what information is presented in the current environment³⁶. Another key finding was that unfair practices are rarely used in isolation, and combining several dark patterns in one interface design is common³⁷.

A study using data crawling methods on 11.000 online shopping sites found that approximately 11% used at least one dark pattern³⁸. However, the authors highlight that the applied method only recognised text-based patterns (such as the omission of information, the use of technical language, etc.) and did not pick up on practices which influence consumers by presenting information in a way which could nudge them towards certain decisions.

A recent mystery shopping exercise showed that dark patterns are prevalent and increasingly used by traders of all sizes, not only large platforms³⁹. According to the study, 97% of the most popular websites and apps used by EU consumers deployed at least one dark pattern, with the most

³² BEUC, 2019, *WTO e-commerce negotiations: BEUC recommendations*. Available at: https://www.beuc.eu/publications/beuc-x-2019-014_wto_e-commerce_negotiations_-_beuc_recommendations.pdf.

³³ For more details, see the CPC sweep on misleading sustainability claims: European Commission, 2021, *Screening of websites for 'greenwashing': half of green claims lack evidence*. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_21_269.

³⁴ BEUC, 2020, *Get rid of greenwashing*. Available at: https://www.beuc.eu/sites/default/files/publications/beuc-x-2020-116_getting_rid_of_green_washing.pdf.

³⁵ Mathur, A. et al., 2019, *Dark patterns at scale: Findings from a crawl of 11K shopping websites*. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), 1-32.

³⁶ Thaler, R. H., & Sunstein, C. R., 2008, *Nudge: improving decisions about health, wealth, and happiness*, 6, 14-38.

³⁷ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

³⁸ Mathur, A. et al 2019, *Dark patterns at scale: Findings from a crawl of 11K shopping websites*. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), 1-32.

³⁹ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

prevalent for e-commerce being hidden information/false hierarchy, countdown timer⁴⁰, preselection, difficult cancellation, nagging⁴¹, forced registrations, and hidden costs⁴².

Studies which also examined presentational aspects found a significantly higher frequency of dark patterns. They demonstrate that the manner of presentation is an important consideration for consumer protection, with some research even suggesting that presentational issues can be considered one of the most important drivers of consumer vulnerability⁴³.

Another European Commission study⁴⁴ on the digitalisation of retail financial services also discovered that, in many instances, essential information was presented to consumers in a way which makes it easy to overlook (e.g., fine print, long text, complicated language, financial and legal jargon). Presenting information on consumer rights in this manner is not in direct violation of the current legislation. For example, the Consumer Rights Directive (CRD)⁴⁵ provides a long list of information which should be provided to consumers at the pre-contractual stage and obliges traders to inform consumers of their 14-day right of withdrawal. However, the directive does not specify *how* this information should be presented. It simply states that it needs to be provided in a “clear and comprehensible manner”, a formulation that can be open to interpretation.

Dark patterns, in most cases, rely on behavioural biases and cognitive limitations to nudge consumers into making certain choices. Firstly, research indicates that consumers’ attention is limited^{46;47}, especially in online environments, since consumers can make fast, automatic decisions⁴⁸. A study using eye-tracking technology found that, on average, 20% of displayed information receives a fair amount of attention, while the rest is almost completely ignored⁴⁹. In an attempt to subconsciously simplify the complex information, consumers in online environments tend to pay attention to the information presented at the top and their attention appears to drop exponentially afterwards⁵⁰. Eye-tracking research also indicates that users tend to focus on content presented in the upper left corner of websites and then proceed to review information placed elsewhere on the page⁵¹. Some traders may use these insights to steer consumers by placing certain information (such as the notice on the 14-day right to withdrawal, the right to a 2-year guarantee or the link to the Online Dispute Resolution (ODR) platform) at the bottom of the page.

⁴⁰ Refers to misleading users by falsely claiming an opportunity ends soon.

⁴¹ Repeated requests urging consumers to complete a certain action.

⁴² European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

⁴³ European Commission, 2016, *Consumer vulnerability in the EU*. Available at: https://ec.europa.eu/info/publications/understanding-consumer-vulnerability-eus-key-markets_en.

⁴⁴ European Commission, 2019, *Behavioural study on the digitalisation of the marketing and distance selling of retail financial services Final Report*. Available at: https://ec.europa.eu/info/sites/info/files/live_work_travel_in_the_eu/consumers/digitalisation_of_financial_services_-_main_report.pdf.

⁴⁵ Directive 2011/83/EU of the European Parliament and of the Council. Available at: <https://eur-lex.europa.eu/eli/dir/2011/83/oj>.

⁴⁶ Chetty, R., Looney, A., & Kroft, K., 2009, Salience and taxation: Theory and evidence. *American economic review*, 99(4), 1145-77.

⁴⁷ DellaVigna, S., & Pollet, J. M., 2009, *Investor inattention and Friday earnings announcements*. *The Journal of Finance*, 64(2), 709-749.

⁴⁸ Sela, A., 2019, e-Nudging justice: the role of digital choice architecture in online courts. *J. Disp. Resol.*, 127.

⁴⁹ Ahn, J. H., Bae, Y. S., Ju, J., & Oh, W., 2018, *Attention adjustment, renewal, and equilibrium seeking in online search: An eye-tracking approach*. *Journal of Management Information Systems*, 35(4), 1218-1250.

⁵⁰ Ibid.

⁵¹ Wedel, M., & Pieters, R., 2017, *A review of eye-tracking research in marketing*. *Review of marketing research*, 123-147.

Finally, some studies indicate that presenting much information could impair consumers' cognitive processes⁵² by, for example, inducing information overload⁵³. The research on consumer attention finds that when the information provided by traders on their websites (potentially in response to the requirements of the consumer acquis) exceeds a certain threshold, information overload can lead to consumer disengagement, i.e., consumers may be dissuaded from acquiring and/or digesting relevant information.

To address these issues, it is important for EU consumer acquis to consider a more user-centric approach to ensure a high level of consumer protection in online markets. In other words, it may not be sufficient for legislators to focus solely on information provision requirements and explore ways in which the law can address misleading and problematic presentation of the information. The evidence suggests that mitigation strategies should focus on improving the transparency of information communicated to consumers⁵⁴ and tackling low consumer awareness of their rights (e.g., through campaigns for educating consumers about available tools and procedures)⁵⁵.

Indeed, a recent European Commission study⁵⁶ concluded that despite the strong EU framework (including GDPR, Unfair Commercial Practices Directive (UCPD) and CRD, among other legislation), some adjustments are needed to address the legal uncertainty. For example, the UCPD seems broad and flexible enough to keep pace with the rapidly changing digital environments successfully, however Annex I currently focuses more on offline practices. There is therefore an opportunity to strengthen consumer protection by expanding the annex with practices used exclusively in online environments. This is especially relevant given that dark patterns, personalisation practices and other issues are constantly evolving.

Similarly, BEUC argues that the current legislative framework does not sufficiently tackle the so-called digital asymmetry⁵⁷. They also endorse expanding the annex of the UCPD, focusing mostly on misleading personalisation practices.

The Digital Service Act (DSA) and Digital Market Act (DMA) are complementary to the UCPD and include, for the first time, an explicit ban on dark patterns. Prohibiting unfair practices that stem from the user interface design and other (misleading) manners of presentation could have a big impact on the consumer protection issues discussed in this section. However, the effectiveness and added value of these bans are already being questioned⁵⁸.

Finally, addressing the current legislative gaps could also have implications for sustainability. Providing consumers with accurate information is a crucial first step to promoting sustainable

⁵² Eppler, M. J., & Mengis, J., 2008, *The concept of information overload-a review of literature from organization science, accounting, marketing, mis, and related disciplines* (2004). *Kommunikationsmanagement im Wandel*, 271-305.

⁵³ Information overload refers to the cognitive challenges, such as wrongly processing or even misunderstanding information, that result from having too much information; see Roetzel, P. G., 2019, *Information overload in the information age: a review of the literature from business administration, business psychology, and related disciplines with a bibliometric approach and framework development*. *Business Research*, 12(2), 479-522.

⁵⁴ Lee, C. K., Yiu, T. W., & Cheung, S. O., 2021, *Intervening Decision-Making in Using Alternative Dispute Resolutions: A Parsimonious Intervention Model*. In *Construction Dispute Research Expanded* (pp. 369-398). Springer, Cham.

⁵⁵ Ibid.

⁵⁶ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

⁵⁷ BEUC, 2022, *Protecting fairness and consumer choice in a digital economy*. Available at: [beuc-x-2022-015_protecting_fairness_and_consumer_choice_in_a_digital_economy.pdf](https://www.beuc.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418).

⁵⁸ Sas, M., 2022, *The Digital Service Act (DSA): A new hope against the dark side of online interfaces?*, Available at: <https://www.law.kuleuven.be/citip/blog/the-digital-service-act-dsa-a-new-hope-against-the-dark-side-of-online-interfaces/>.

behaviour, even if it does not address the attitude-behaviour gap. Digital tools (when done right) can help consumers easily access various information on products and services they wish to purchase⁵⁹. For example, platforms could provide filters which would allow consumers to select only products which are eco-friendly or made sustainably. Addressing the gaps in the current legislative framework cannot only strengthen consumer protection in the internal market but also provide an opportunity to promote more environmentally friendly consumption.

2.3.2. The increase in personalisation practices raises concerns over consumer protection

In recent years, there has been an increase in consumer issues stemming from various personalisation practices. Increased use of online platforms and technological developments have enabled some traders to collect vast amounts of personal information on consumers. While some experts argue that personalisation is not problematic since traders should be compliant with the General Data Protection Regulation (GDPR)⁶⁰, others suggest that the requirement for explicit consent can be influenced by misleading information that steers the consumer towards choices that are convenient for the trader. A common example includes a situation in which it is straightforward to “accept all cookies”. This can give access to information such as past searches and consent to use personalised advertisement and communication even though consumers are rarely aware of what they have agreed to⁶¹. The fact that consumers are often unaware that personalisation is used (and how)⁶² creates a digital asymmetry – i.e. an imbalance of power between consumers and data-driven traders⁶³.

In practice, traders usually personalise the information provided to consumers by using targeted advertising, personalised ranking of offers/search results and personalised pricing, which are discussed below. The Omnibus directive⁶⁴ provides disclosure obligations on personalised pricing. In particular, art. 6 states that companies must clearly indicate the use of personalised pricing prior to the purchase, and consumers must also understand in what ways their personal data affect prices. The Dutch Authority for Consumer and Markets (ACM) found that the online platform Wish used personalised pricing without disclosing it to consumers. Interestingly, the online platform decided to end the practice in 2022 instead of increasing transparency about how personalised pricing was used, as had been demanded by the ACM⁶⁵.

⁵⁹ E-commerce Europe, 2021, *Collaborative report on sustainability and e-Commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

⁶⁰ For example, see: Strycharz, J., van Noort, G., Helberger, N., & Smit, E., 2019, *Contrasting perspectives—practitioner’s viewpoint on personalised marketing communication*. *European Journal of Marketing*, 53(4), 635-660.

⁶¹ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

⁶² Ibid.

⁶³ BEUC, 2022, *Consumer protection 2.0: Protecting fairness and consumer choice in a digital economy*. Available at: [beuc-x-2022-015_protecting_fairness_and_consumer_choice_in_a_digital_economy.pdf](https://www.beuc.eu/2022/01/15/protecting-fairness-and-consumer-choice-in-a-digital-economy.pdf).

⁶⁴ European Commission, 2019, *Better enforcement and modernisation of union consumer protection rules*, (EU)2019/2161. Available at: <https://eur-lex.europa.eu/eli/dir/2019/2161/oj>.

⁶⁵ ACM, 2022, *Following ACM actions, Wish bans fake discounts and blocks personalized pricing*. Available at: <https://www.acm.nl/en/publications/following-acm-actions-wish-bans-fake-discounts-and-blocks-personalized-pricing>.

Targeted advertising has become a large and growing market in recent years due to the more frequent use of big data in online environments⁶⁶. According to the most recent Eurostat⁶⁷ figures, in 2018, 25% of EU-27 enterprises paid to advertise online. When looking at different types of targeted advertisements, the data show that:

- Around 8% of advertisements were personalised based on the individual's past behaviour (e.g., past searches or previous purchases on the website);
- Around 9% presented advertisements based on the consumer's geolocation; and
- Approximately 10% of enterprises used some other method of targeted advertising.

Another common practice is personalising the ranking of offers or search results, also known as price steering, where the order of search results is altered to highlight specific goods and services (e.g., showing high-value offers first). Currently there is limited literature on the topic, since it is difficult to identify situations in which sellers use personalised rankings⁶⁸. Nonetheless, one study found evidence of personalised ranking being used on "Google Shopping", a service provided by Google which allows users to search for products on online shopping websites and compare prices between different vendors⁶⁹. Furthermore, a mystery shopping exercise⁷⁰ showed that accessing a trader's website through a price comparison website or using a mobile device appeared to lead to a higher frequency of personalisation. Overall, the study found that over half of the screened websites personalise offers based on the access route, while around 44% use individual's past behaviour to personalise their offers. Moreover, there is evidence that such price steering may become more important as e-commerce continues to grow⁷¹.

Price personalisation is not a new practice since firms have used some degree of price discrimination in the past. This usually included some form of grouping and segmenting consumers according to easily observable criteria such as geographical location, age, gender, to name a few⁷². In practice, this appeared as student discounts, "early bird" prices, offers for seniors etc. However, the development of e-commerce platforms has enabled traders to move towards first-degree price discrimination⁷³ – a situation in which firms can charge each consumer the maximum price they are willing to pay. In other words, recent digital developments have created an opportunity where sellers could create a unique price for each customer. However, a recent European Commission study⁷⁴ did not find evidence for systemic attempts to personalise prices to such a degree. When personalisation was detected, it was generally small in magnitude, fluctuating on average between 1% and 4%. Furthermore, the results suggest that smaller sellers have a higher tendency to personalise prices.

⁶⁶ European Commission, 2018, *Consumer market study on online market segmentation through personalised pricing/offers in the European Union*. Available at: https://ec.europa.eu/info/publications/consumer-market-study-online-market-segmentation-through-personalised-pricing-offers-european-union_en.

⁶⁷ Eurostat, 2022, *Social media use by type, internet advertising*, [indicator: isoc_cismt]. Available at: https://ec.europa.eu/eurostat/databrowser/view/isoc_cismt/default/table?lang=en.

⁶⁸ Niemeier, C. R., 2020, *Online price discrimination: precursors to a quantitative study of different approaches*. In European Scientific Conference of Doctoral Students (p. 139).

⁶⁹ Cozza, V., Hoang, V. T., Petrocchi, M., & Spognardi, A., 2016, *Experimental measures of news personalization in google news*. In International Conference on Web Engineering (pp. 93-104). Springer, Cham.

⁷⁰ European Commission, 2018, *Consumer market study on online market segmentation through personalised pricing/offers in the European Union*. Available at: https://ec.europa.eu/info/publications/consumer-market-study-online-market-segmentation-through-personalised-pricing-offers-european-union_en.

⁷¹ Ibid.

⁷² Ibid.

⁷³ Ibid.

⁷⁴ Ibid.

Finally, more recent developments indicate the emergence of a new generation of unfair practices involving personalised practices and so-called dark patterns that make it even more difficult for consumers and authorities to recognise them⁷⁵. For example, sellers could use the default bias to steer consumers towards accepting the traders' preferred cookie policy, allowing them to personalise the information provided to the consumer⁷⁶.

Indeed, one of the key concerns about personalisation is that it is very challenging to identify⁷⁷. By definition, personalised offers are only visible to the individual they are created for, which creates challenges for enforcing consumer rights. The rise of the platform economy means that personalised practices are likely to grow in prominence⁷⁸. Mostly because these online marketplaces can leverage data from large groups of customers,⁷⁹ and new technological developments in fields such as AI and big data, enable more sophisticated data analytics⁸⁰.

⁷⁵ Einstein, M., 2020, Advertising Technologies, Tactics, and Aftermaths: The Unintended Consequences of Social Media, Branded Content, and Data Mining. Advertising & Society Quarterly 21(3).

⁷⁶ For more details on dark patterns, see the section below.

⁷⁷ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

⁷⁸ European Commission, 2022, *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Available at: <https://op.europa.eu/en/publication-detail/-/publication/606365bc-d58b-11ec-a95f-01aa75ed71a1/language-en/format-PDF/source-257599418>.

⁷⁹ OECD, 2016, *Price Discrimination: Background Note by the Secretariat*. Available at: [https://one.oecd.org/document/DAF/COMP\(2016\)15/en/pdf](https://one.oecd.org/document/DAF/COMP(2016)15/en/pdf).

⁸⁰ Neagu, A., 2016, *How Artificial Intelligence is reshaping eCommerce Personalisation*. Available at: <https://blog.retargeting.biz/how-artificial-intelligence-is-reshaping-ecommercepersonalisation/>.

3. ENVIRONMENTAL FOOTPRINT OF E-COMMERCE

KEY FINDINGS

While specific features characterise e-commerce business models, more recently the **dichotomy between online and offline retail commerce has become increasingly blurred**, and the environmental footprints of these two business models are becoming intertwined.

At the same time, differences remain for product delivery and returns. Different kinds of e-commerce businesses lend themselves to different forms of sustainability innovation. The opportunities for innovation differ, especially between businesses that sell services, including online services, and those that primarily sell physical goods.

Currently, **there is no single approach that is systematically applied to fully capture the total environmental footprint of e-commerce**. There are, however, different approaches to arrive at a partial assessment of the impact of e-commerce merchants and the products and services sold online.

This study finds that **the majority of approaches are insufficiently sound from a scientific point of view for calculating the environmental footprint of e-commerce**. After weighing the soundness of the approach with the soundness of its application in practice, no application is found to be scientifically sound. Applications in product or organisational life cycle assessments are found to be the most sound, while the least sound applications are found within certification schemes.

The rapidly growing volume of e-commerce outlined in the previous section comes with an increasing environmental footprint across the entire value chain⁸¹. The term “*environmental footprint*” may be understood in different ways. For example, while the European Commission (EC) may refer to it as a quantitative assessment of environmental impacts done in compliance with the Environmental Footprint (EF) methods⁸², in this study, we consider a broader meaning encompassing other environmental assessments, on top of the EF methods.

Currently, there is no single approach that is systematically applied to fully capture the total environmental footprint of e-commerce. There are, however, different approaches to arriving at a partial assessment:

- Section 3.1 outlines overarching approaches used in scientific studies and in the commercial sector.
- Section 3.2 evaluates the scientific soundness of those approaches.

3.1. Different stakeholder groups use different approaches to calculate the environmental footprint of e-commerce

The approaches used to calculate the environmental footprint of e-commerce differ significantly between stakeholder groups. This makes it difficult to compare or synthesise results directly. To present the findings in a structured and clear manner, we cluster the identified approaches into three overarching categories:

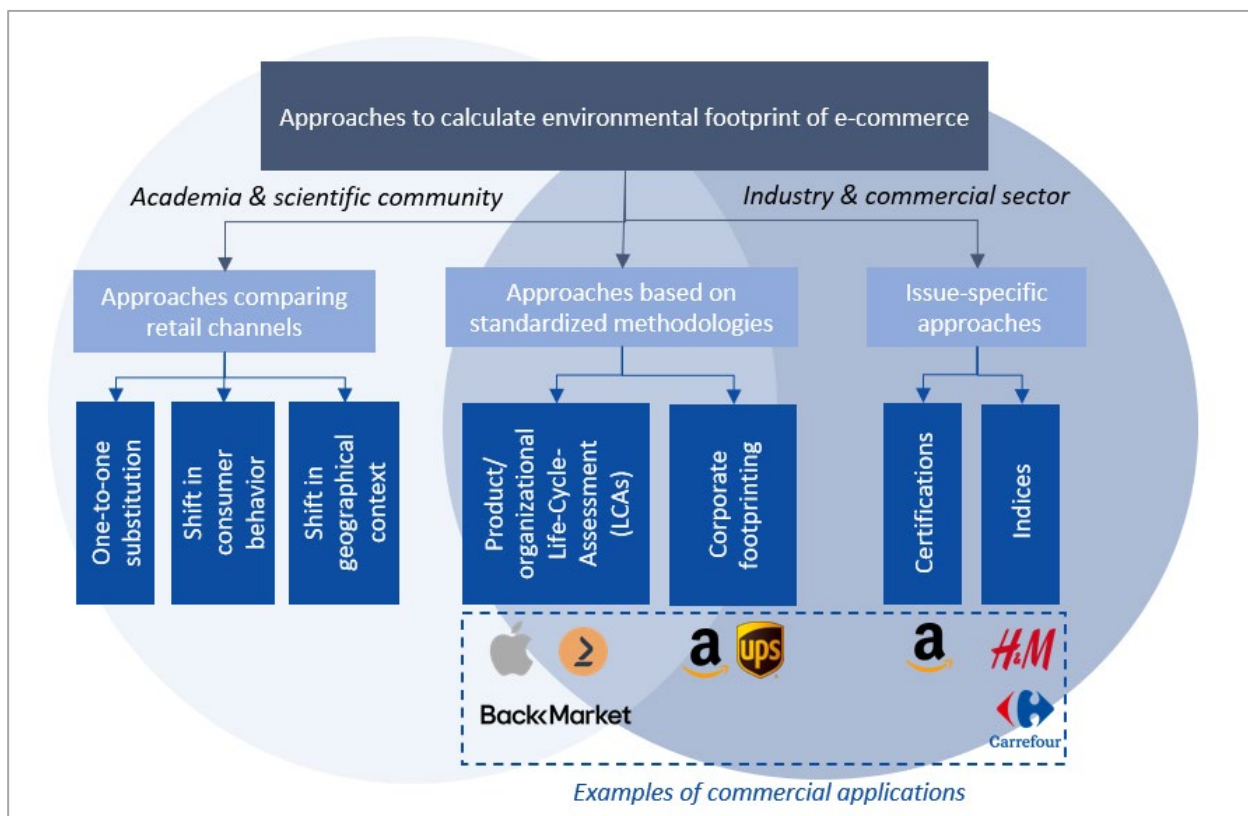
⁸¹ E-Commerce Europe, 2021, *European E-Commerce Report*, Light Version. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/09/2021-European-E-commerce-Report-LIGHT-VERSION.pdf>.

⁸² European Commission, 2021, *Environmental Footprint Methods Recommendation*. Available at: https://ec.europa.eu/environment/eussd/smgp/ef_methods.htm.

- Approaches comparing retail channels,
- Approaches based on standardised methodologies, and
- Issue-specific approaches (Figure 8).

A strict separation is difficult due to overlapping methodologies; hence, the presented categories are not always mutually exclusive. The following sections describe the approaches per category. For approaches based on standardised methodologies and issue-specific approaches, information boxes present examples of how relevant e-commerce merchants practically apply standardised approaches.

Figure 8: Categorisation of current approaches to calculating the environmental footprint of e-commerce



Source: PRé Sustainability.

3.1.1. Academia and the scientific community mainly compare the environmental footprints of different retail channels and their associated logistics

There is a strict separation of how the bulk of scientific literature calculates the impacts arising from e-commerce, as opposed to how it is done in practice by e-commerce merchants. Scientific literature mainly aims at comparing the environmental impacts of e-commerce to other retail channels (such as traditional brick-and-mortar stores or omnichannels such as click-and-

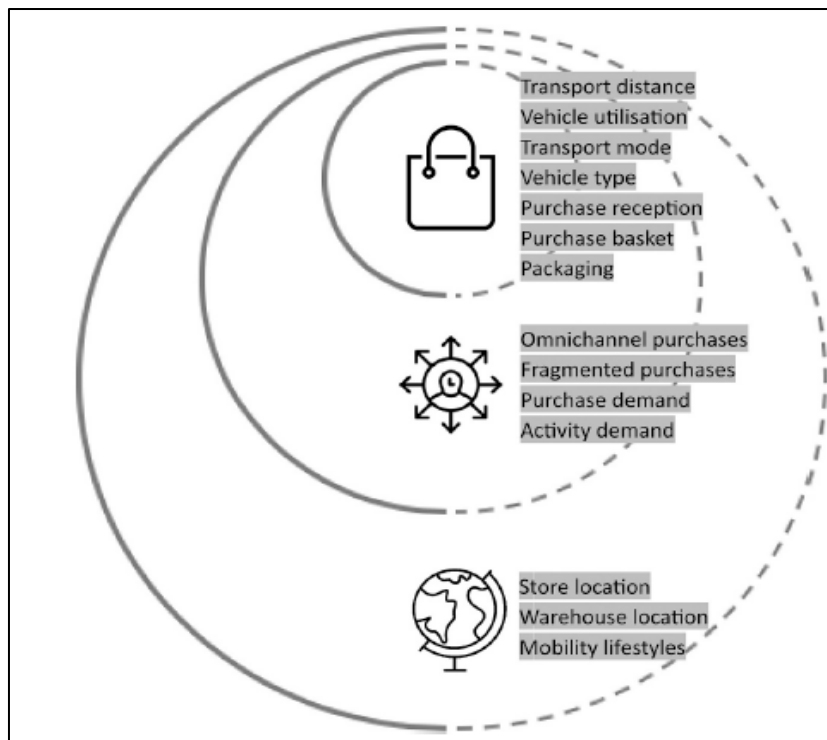
collect)^{83;84;85;86;87;88;89;90;91;92;93;94}. These approaches aim to compare the environmental footprints arising from purchasing products via different retail channels and evaluate different parameters specific to each retail channel. Parameters of interest mainly concern storage & logistical management and the transport to the consumer. The methods largely build on mathematical models, using parameters and variables to calculate the environmental footprints of different scenarios for different retail channels.

Due to the comparative nature of the approaches, the environmental footprint of the production, use, and end-of-life treatment of the products or services offered through the channels are usually excluded from the calculations. The argument is that the products sold are the same between various retail channels; hence, they do not serve the comparison.

Figure 9 presents a framework based on a systematic literature review of academic literature assessing the net environmental impact of online shopping⁹⁵. It shows that the approaches comparing retail channels can be fitted into three subcategories: the one-to-one substitution (inner circle), shift in consumer behaviour (middle circle), and shift in geographical context (outer circle). The categories mainly reflect which key parameters are included in the scope of the analyses.

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- ⁸³ ob, K., & Postpisch, R., 2019. *Kurzanalyse E-Commerce vs. stationärer Handel: Die Umwelt- und Ressourcenwirkungen im Vergleich*. Available at: www.ressourcenpolitik.de.
- ⁸⁴ Shahmohammadi, S., et al., 2020, Comparative Greenhouse Gas Footprinting of Online versus Traditional Shopping for Fast-Moving Consumer Goods: A Stochastic Approach. *Environmental Science and Technology*, 54 (6), pp. 3499–3509. Available at: <https://doi.org/10.1021/acs.est.9b06252>.
- ⁸⁵ Weideli, D., 2013, *Environmental Analysis of US Online Shopping*. MIT Center for Transportation & Logistics. Available at: <https://ctl.mit.edu/pub/thesis/environmental-analysis-us-online-shopping>.
- ⁸⁶ Muñoz-Villamizar, A., et al., 2021, *The environmental impact of fast shipping e-commerce in inbound logistics operations: A case study in Mexico*. *Journal of Cleaner Production*, 283. Available at: <https://doi.org/10.1016/j.jclepro.2020.125400>.
- ⁸⁷ Allen, J. et al., 2018, *Understanding the impact of e-commerce on last-mile light goods vehicle activity in urban areas: The case of London*. *Transportation Research Part D: Transport and Environment* 61, pp. 325–338. Available at: <https://doi.org/10.1016/j.trd.2017.07.020>.
- ⁸⁸ Edwards, J. B., & McKinnon, A. C., 2009, *Shopping trip or home delivery _ which has the smaller carbon footprint*. CILT Supply Chan. Available at: https://www.abtslogistics.co.uk/green-logistics-resources/343c5312-af8f-4cc0-a271-4191cb2ccdff_Edwards-McKinnon-ShoppingTripOrHomeDelivery-FocusLogisticsJuly2009.pdf.
- ⁸⁹ OliverWyman, 2021, *Is e-commerce good for europe? economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-ecommerce-good-for-europe.pdf>.
- ⁹⁰ Pålsson, H., et al., 2017, Energy consumption in e-commerce versus conventional trade channels - Insights into packaging, the last mile, unsold products and product returns. *Journal of Cleaner Production*, 164, pp. 765–778. Available at: <https://doi.org/10.1016/j.jclepro.2017.06.242>.
- ⁹¹ Dost, F., & Maier, E., 2018, *E-commerce effects on energy consumption: A multi-year ecosystem-level assessment*. *Journal of Industrial Ecology* 22 (4), pp. 799–812. Available at: <https://doi.org/10.1111/jiec.12639>.
- ⁹² Zennaro, I., Finco, S., Calzavara, M., & Persona, A., 2022, *Implementing E-Commerce from Logistic Perspective: Literature Review and Methodological Framework*. *Sustainability (Switzerland)*, 14(2). Available at: <https://doi.org/10.3390/su14020911>.
- ⁹³ Fu, A. J., & Saito, M., 2018, *Would You Be Willing to Wait?: Consumer Preference for Green Last Mile Home Delivery*. Available at: https://dspace.mit.edu/bitstream/handle/1721.1/117624/Fu_Saito_2018_Capstone.pdf.
- ⁹⁴ Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. *Journal of Transport Geography*, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.
- ⁹⁵ Ibid.

Figure 9: Framework for understanding the net environmental sustainability of shopping⁹⁶



Source: Buldeo Rai, H., 2021, The net environmental impact of online shopping, beyond the substitution bias.

a. One-to-one substitution of products in e-commerce

This approach is defined by the “substitution hypothesis”, which assumes that online retail channels replace physical retail channels without any effects on individual or household patterns. The purchased product is assumed to be the same across various channels⁹⁷.

Among the studies evaluated, the most commonly used indicator for quantifying the environmental impacts of e-commerce is the carbon or GHG footprint per unit fulfilled (CO₂-equivalents/unit fulfilled)^{98;99;100;101;102;103}. This, however, excludes the footprint of the production, the use, and the end-of-life treatment of the product itself. Another indicator used less frequently is energy efficiency per

⁹⁶ Ibid.

⁹⁷ Ibid.

⁹⁸ Shahmohammadi, S., et al., 2020, Comparative Greenhouse Gas Footprinting of Online versus Traditional Shopping for Fast-Moving Consumer Goods: A Stochastic Approach. *Environmental Science and Technology*, 54 (6), pp. 3499–3509. Available at: <https://doi.org/10.1021/acs.est.9b06252>.

⁹⁹ Muñoz-Villamizar, A., et al., 2021, *The environmental impact of fast shipping ecommerce in inbound logistics operations: A case study in Mexico*. *Journal of Cleaner Production*, 283. Available at: <https://doi.org/10.1016/j.jclepro.2020.125400>.

¹⁰⁰ Ibid.

¹⁰¹ Edwards, J. B., & McKinnon, A. C., 2009, *Shopping trip or home delivery _ which has the smaller carbon footprint*. CLT Supply Chan. Available at: https://www.abtslogistics.co.uk/green-logistics-resources/343c5312-af8f-4cc0-a271-4191cb2ccdff_Edwards-McKinnon-ShoppingTripOrHomeDelivery-FocusLogisticsJuly2009.pdf.

¹⁰² Allen, J. et al., 2018, *Understanding the impact of e-commerce on last-mile light goods vehicle activity in urban areas: The case of London*. *Transportation Research Part D: Transport and Environment* 61, pp. 325–338. Available at: <https://doi.org/10.1016/j.trd.2017.07.020>.

¹⁰³ OliverWyman, 2021, *Is e-commerce good for europe? Economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-ecommerce-good-for-europe.pdf>.

unit fulfilled, calculated on the basis of energy consumption per unit¹⁰⁴. Only in one case, the product's embodied energy was included in the footprint, specifically when the product was returned and deliberately destroyed upon return¹⁰⁵. Less frequently used indicators include land use and occupation, and traffic arising from e-commerce¹⁰⁶.

The parameters identified as relevant for this approach include transport distances, vehicle utilisation, transport mode, vehicle types, purchase reception (some including failed deliveries or returns), purchase basket size, and additional packaging^{107;108;109}. Those parameters serve the quantification of direct transport impacts¹¹⁰. The parameters are multiplied with GHG emission factors taken from databases or previous studies to obtain the environmental footprints.

Some product categories show significantly larger environmental footprints than others. The likelihood that a product bought online fulfils the customer's expectations is higher for so-called "search goods" (e.g., books) than for "experience goods" (e.g., clothes)¹¹¹. Therefore, certain product categories are assumed to have higher return rates, resulting in significantly larger environmental footprints. Table 2 shows recent research on the GHG emissions (in grams CO₂-equivalents) per average non-food product purchased online and delivered in Europe (excl. production). The impact is significantly larger for fashion items than for books¹¹².

Table 2: Emissions of average non-food online purchase in Europe in 2019, by product, in grams CO₂-eq¹¹³

	France	Germany	Italy	Spain	UK
Fashion (400 grams product)*	593	1096	1047	1166	854
Books (350 grams product)*	273	829	696	605	583
Consumer electronics (250 grams product)*	428	914	870	860	638
Average cross-product**	397	988	898	897	729

Source: Oliver Wyman, 2021, *Is e-commerce good for Europe? Economic and environmental impact study*.

The overall tendency of results obtained with this approach is that the environmental footprint is more favourable for products purchased through e-commerce channels than in traditional retail¹¹⁴. This is

¹⁰⁴ Pålsson, H., et al., 2017, Energy consumption in e-commerce versus conventional trade channels - Insights into packaging, the last mile, unsold products and product returns. *Journal of Cleaner Production*, 164, pp. 765–778. Available at: <https://doi.org/10.1016/j.jclepro.2017.06.242>.

¹⁰⁵ Ibid.

¹⁰⁶ OliverWyman, 2021, *Is e-commerce good for europe? Economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-ecommerce-good-for-europe.pdf>.

¹⁰⁷ Shahmohammadi, S., et al., 2020, Comparative Greenhouse Gas Footprinting of Online versus Traditional Shopping for Fast-Moving Consumer Goods: A Stochastic Approach. *Environmental Science and Technology*, 54 (6), pp. 3499–3509. Available at: <https://doi.org/10.1021/acs.est.9b06252>.

¹⁰⁸ Weideli, D., 2013, *Environmental Analysis of US Online Shopping*. MIT Center for Transportation & Logistics. Available at: <https://ctl.mit.edu/pub/thesis/environmental-analysis-us-online-shopping>.

¹⁰⁹ Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. *Journal of Transport Geography*, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.

¹¹⁰ Ibid.

¹¹¹ Pålsson, H., et al., 2017, Energy consumption in e-commerce versus conventional trade channels - Insights into packaging, the last mile, unsold products and product returns. *Journal of Cleaner Production*, 164, pp. 765–778. Available at: <https://doi.org/10.1016/j.jclepro.2017.06.242>.

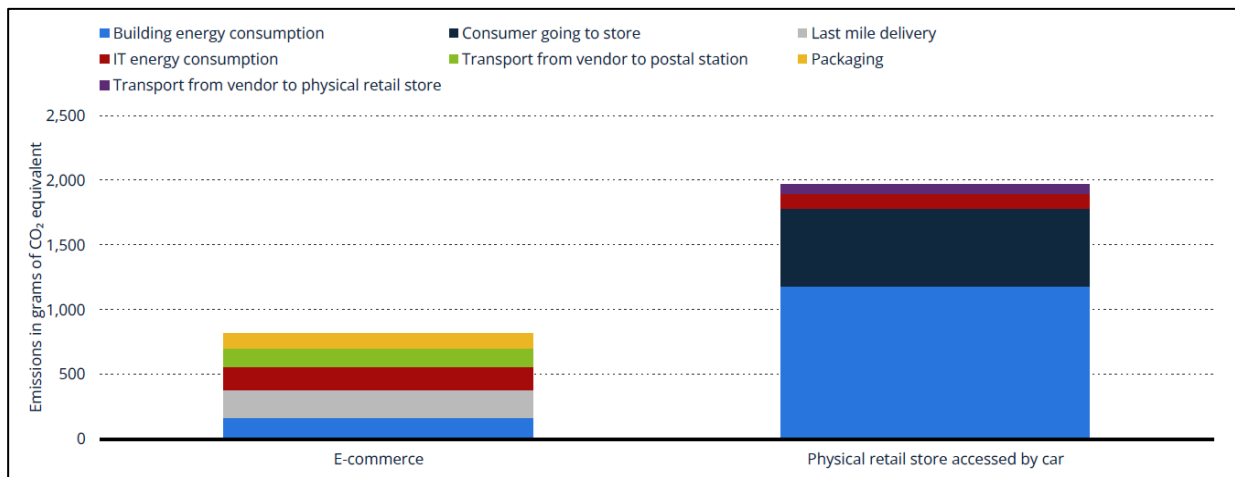
¹¹² OliverWyman, 2021, *Is e-commerce good for Europe? Economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-ecommerce-good-for-europe.pdf>.

¹¹³ Ibid.

¹¹⁴ Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. *Journal of Transport Geography*, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.

mainly due to the large impacts caused by individual transport in traditional retail (usually assumed to be a personal car). Figure 10 shows the emissions of an average non-food product purchased through e-commerce and in physical retail. Physical retail has an assumed footprint of more than double that of e-commerce, largely due to the buildings' energy consumption and the consumer driving in a vehicle to the store¹¹⁵.

Figure 10: Emissions of an average non-food purchase in Europe 2019, by channel¹¹⁶



Source: Statista, 2021, Sustainability in e-commerce.

Some studies, however, reach opposite results. When including factors such as increased product returns, failed deliveries, and additional packaging for e-commerce, then the environmental footprint can become larger for online shopping than for traditional retail channels¹¹⁷. Figure 11 shows the GHG emissions (in kg CO₂-eq.) for single clothes items purchased online under different assumptions¹¹⁸. It shows that the most influential variable determining the environmental footprint of e-commerce is the number of items ordered that are returned to the retailer (scenario "a lot back": six return items – bottom graph). The largest contributors, in this case, are the transport to the consumer (light grey) and back to the retailer (dark grey) and packaging requirements for delivery and returns (white). When considering those scenarios, the environmental footprint of e-commerce can rise to over 300% of the original default scenario. Cases, where the consumer returns many items, could flip the comparative environmental footprint to favour traditional commerce over e-commerce.

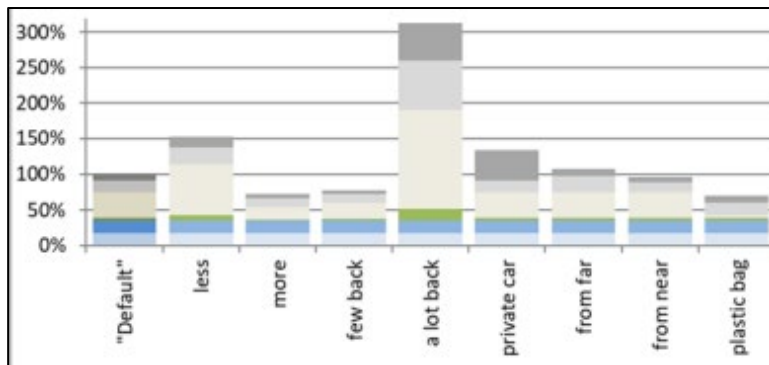
¹¹⁵ OliverWyman, 2021, *Is e-commerce good for europe? Economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-ecommerce-good-for-europe.pdf>.

¹¹⁶ Ibid.

¹¹⁷ Hischer, R., 2018, *Car vs. Packaging - A First, Simple (Environmental) Sustainability Assessment of Our Changing Shopping Behaviour*. Sustainability, 10 (9), 3061. Available at: <https://doi.org/10.3390/su10093061>.

¹¹⁸ Ibid.

Figure 11: Sensitivity scenarios of GHG emissions (in kg CO₂-eq.) per single clothes items purchased online¹¹⁹



Source: Hischier, R., 2018, Car vs. Packaging—A First, Simple (Environmental) Sustainability Assessment of Our Changing Shopping Behaviour.

b. Shifts in consumer behaviour due to e-commerce

Even though most scientific knowledge adopts the approach of one-to-one substitution of products, research considering behavioural changes caused by e-commerce is growing.

This approach goes beyond the substitution hypothesis by considering the wider effects of consumer behaviour induced by e-commerce on the environmental footprint. It can be argued that e-commerce purchases are not direct substitutes for traditional shopping and that the availability of e-commerce influences consumer behaviour at a broader level¹²⁰. Therefore, the substitution hypothesis exaggerates the potential of e-commerce to reduce environmental impacts¹²¹. The overall sentiment is that online shopping can have behavioural effects on the consumer, which should be included when assessing the environmental footprint of e-commerce practices. For clothing, one online purchase usually replaces one purchase in a physical store. For digital devices and travels purchased online, a direct increase in a number of purchases has been found compared to in-store purchasing behaviour¹²².

The wider influence of e-commerce on consumer behaviour and consumption in these kind of approaches relates to: *omnichannel purchasing* (the combination of purchase channels), *fragmented purchasing* (more frequent purchases with fewer items from more retailers), *increased purchasing demand* and *altered activity demand of the consumers*¹²³. However, like for the first category of approaches, the impacts associated with the production, the use, and the end-of-life of the products or services are usually excluded from the assessment.

¹¹⁹ Ibid.

¹²⁰ Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. Journal of Transport Geography, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.

¹²¹ Ibid.

¹²² Frick, V., & Matthies, E., 2020, *Everything is just a click away. Online shopping efficiency and consumption levels in three consumption domains*. Sustainable Production and Consumption, 23, pp. 212–223. Available at: <https://doi.org/10.1016/j.spc.2020.05.002>.

¹²³ Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. Journal of Transport Geography, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.

The methods used in this approach are often not entirely quantitative but use mixed methods to capture the direct and indirect effects of e-commerce^{124;125}. Direct transport effects are measured like the one-to-one substitution¹²⁶. Advanced modelling, such as Empirical Dynamic Modelling (EDM) can lift this approach to the systemic level and is used to model complex interrelated system effects¹²⁷. The ability to include nonlinear and state-dependent effects between variables is highly relevant to measure first-, second-, and third-order effects of e-commerce on the system. This method allows for example associating sectoral energy consumption shifts with online retailing¹²⁸. Indirect effects, changes in consumer behaviour, are often measured qualitatively¹²⁹. Consumer behaviour affecting the environmental performance of purchasing scenarios is, for example assessed with the help of surveys, e.g. to study consumers' willingness to wait for product deliveries to save emissions¹³⁰. The survey presents different incentives of decreasing the environmental footprint, which would in turn inform the scenarios for quantitative assessment¹³¹.

Interestingly, when including the wider effects on consumer behaviour induced by online shopping in the calculations, the comparative environmental footprint of products purchased is found to tip towards favouring traditional retail over online retail¹³². Therefore, systemic dynamics, or the larger effects on the system caused by online shopping, play a key role when assessing the environmental footprint of online shopping.

c. Shifts in geographical contexts due to e-commerce

This approach includes parameters concerning the wider geographical context, such as area density and urban, suburban, or rural settings in which the purchasing occurs¹³³. Parameters of relevance are categorised into *store location* (the relocation of store networks due to, e.g. local store declines caused by e-commerce), *warehouse location* (centralised or decentralised warehouse locations), and *mobility lifestyle* (long-term effects on mobility due to location changes)¹³⁴. The resulting consequences of those parameters on the environmental impact of e-commerce are usually measured in GHG emissions^{135;136;137}. In addition, in this approach, qualitative information on the relationship between

¹²⁴ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

¹²⁵ Fu, A. J., & Saito, M., 2018, *Would You Be Willing to Wait?": Consumer Preference for Green Last Mile Home Delivery*. Available at: https://dspace.mit.edu/bitstream/handle/1721.1/117624/Fu_Saito_2018_Capstone.pdf.

¹²⁶ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

¹²⁷ Dost, F., & Maier, E., 2018, *E-commerce effects on energy consumption: A multi-year ecosystem-level assessment*. *Journal of Industrial Ecology* 22 (4), pp. 799–812. Available at: <https://doi.org/10.1111/jiec.12639>.

¹²⁸ Ibid.

¹²⁹ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

¹³⁰ Fu, A. J., & Saito, M., 2018, *Would You Be Willing to Wait?: Consumer Preference for Green Last Mile Home Delivery*. Available at: https://dspace.mit.edu/bitstream/handle/1721.1/117624/Fu_Saito_2018_Capstone.pdf.

¹³¹ Ibid.

¹³² Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. *Journal of Transport Geography*, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.

¹³³ Ibid.

¹³⁴ Ibid.

¹³⁵ Ibid.

¹³⁶ Wygonik, E., Goodchild, A., 2012, *Evaluating the efficacy of shared-use vehicles for reducing greenhouse gas emissions: A U.S. case study of grocery delivery*. *J. Transp. Res. Forum* 51. Available at: <https://doi.org/10.5399/osu/jtrf.51.2.2926>.

¹³⁷ Ren, F., Kwan, M.P., 2009, *The impact of geographic context on e-shopping behavior*. *Environ. Plan. B Plan. Des.* 36, pp. 262–278. Available at: <https://doi.org/10.1068/b3401>.

geographic context and purchasing behaviour, such as through interviews with consumers in different geographical areas¹³⁸, support the quantitative analysis.

Even when including the wider geographic implications of e-commerce, the impact of remote e-commerce (over-sea transport) is rarely included in the assessments¹³⁹. Including additional environmental impacts stemming from long-distance freight transport (by air or ship) is essential to reflect the environmental impacts of e-commerce realistically. The scientific community acknowledges the need for future research to include impacts further up the transportation flow, such as long-distance transport, to establish a realistic comparison between offline and online retailing^{140;141}.

3.1.2. The scientific community and policy makers provide approaches based on standardised methodologies to be applied in industry for assessing the environmental footprint of products or organisations

As opposed to the comparative approach described above, **approaches based on standardised methodologies are mainly developed by the scientific community and policy makers to be applied by industry to enhance comparability**. The aim is to assess the environmental impacts arising from the full life cycle of products or organisations. This can produce more substantiated and also more comparable assessments, thus can also be useful in ESG reporting¹⁴².

To explain the difference between various approaches, approaches based on standardised methodologies are divided into life cycle assessment (LCA) approaches for products or entire organisations or the widely applied approach of corporate footprinting. Those two categories are not mutually exclusive as they share similar methodologies; they however differ in purpose and thus are explained in separation.

d. Life-Cycle Assessments (LCAs) cover the entire life cycle of products or entire organisations in e-commerce

Life-Cycle Assessment (LCA) is a scientific methodology to calculate the environmental footprints of the entire life cycle of either a product or the function of a product in multiple impact categories, depending on the method used¹⁴³. Figure 12 shows a visualisation of the product life cycle stages usually included in an LCA.

¹³⁸ Ibid.

¹³⁹ Mangiaracina, R., et al., 2016, *Assessing the environmental impact of logistics in online and offline B2C purchasing processes in the apparel industry*. Int. J. Logist. Syst. Manag. 23, 98. Available at: <https://doi.org/10.1504/IJLSM.2016.073300>.

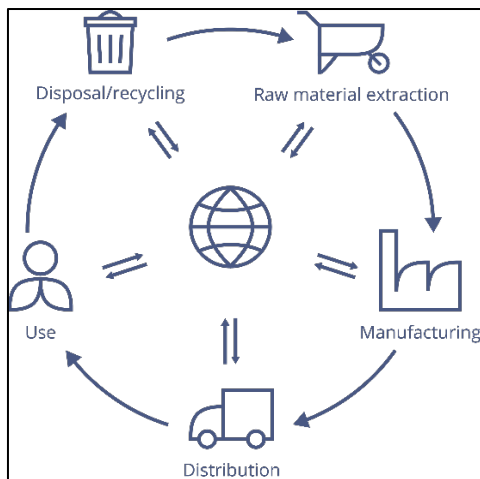
¹⁴⁰ Fu, A. J., & Saito, M., 2018, *Would You Be Willing to Wait?: Consumer Preference for Green Last Mile Home Delivery*. Available at: https://dspace.mit.edu/bitstream/handle/1721.1/117624/Fu_Saito_2018_Capstone.pdf.

¹⁴¹ Buldeo Rai, H., 2021, *The net environmental impact of online shopping, beyond the substitution bias*. Journal of Transport Geography, 93. Available at: <https://doi.org/10.1016/j.jtrangeo.2021.103058>.

¹⁴¹ Schmitz, T., 2020, *Critical analysis of carbon dioxide emissions in a comparison of e-commerce and traditional retail*. Journal of Applied Leadership Management 8, pp. 72–89. Available at: <https://www.econstor.eu/bitstream/10419/251927/1/1748266055.pdf>.

¹⁴² The term ESG refers to the disclosure of environmental, social and governance (ESG) impacts of a company or organizations for public reporting purposes.

¹⁴³ Golsteijn, L., 2022, *Life Cycle Assessment (LCA) explained*. Available at: <https://pre-sustainability.com/articles/life-cycle-assessment-lca-basics/>.

Figure 12: Diagram of product life cycle stages covered by an LCA¹⁴⁴

Source: PRé Sustainability.

Commonly, it is referred to as “cradle-to-grave” analysis and is used to quantify environmental impacts associated with an entire product system¹⁴⁵. LCAs can be conducted on product-level (P-LCA), or on organisational-level (O-LCA). Both approaches can contribute to calculating the environmental footprint of e-commerce – either on individual product-level or for product groups retailed through e-commerce, or on organisational-level for e-commerce merchants. If applied in the setting of e-commerce, both approaches allow to capture the distinct characteristics of the supply chains associated with online retailing due to the focus on the entire life cycle. LCAs for capturing the environmental impacts of services are not yet as sophisticated.

There are standards from the International Organisation for Standardisation (ISO), such as the ISO 14040 and ISO 14044, defining the principles and framework, requirements and guidelines of conducting an LCA in general¹⁴⁶. The ISO 14067 standard provides requirements and guidelines for conducting a product’s carbon footprint¹⁴⁷. If a P-LCA is to be used for external communication, it must be third-party reviewed and in alignment with (one of) those ISO standards. Therefore, those standards are of high importance. A comparative assertion, meaning to publicly compare the environmental footprint of one product to another, is only allowed with third-party reviewed P-LCAs, while the O-LCA methodology currently is still lacking a consistent basis for comparison¹⁴⁸. Box 1 presents an example of a practical application of the LCA approach by Apple.

¹⁴⁴ Ibid.

¹⁴⁵ European Environment Agency, 2022, *Life Cycle Assessment*. Available at: [https://www.eea.europa.eu/help/glossary/eea-glossary/life-cycle-assessment#:~:text=Life%2Dcycle%20assessment%20\(LCA\),use%20efficiency%20and%20decreasing%20liabilities](https://www.eea.europa.eu/help/glossary/eea-glossary/life-cycle-assessment#:~:text=Life%2Dcycle%20assessment%20(LCA),use%20efficiency%20and%20decreasing%20liabilities).

¹⁴⁶ ISO, 2006, *Environmental management Life cycle assessment — Requirements and guidelines*. Available at: <https://www.iso.org/standard/38498.html>.

¹⁴⁷ ISO, 2018, *Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification*. Available at: <https://www.iso.org/standard/71206.html>.

¹⁴⁸ United Nations Environment Programme. 2015, *Guidance on Organizational Life Cycle Assessment*, Available at: https://www.lifecycleinitiative.org/wp-content/uploads/2015/04/o-lca_24.4.15-web.pdf.

Box 1: Life cycle assessments (LCA) in electronics – the example of Apple

Apple¹⁴⁹ provides product environmental reports based on LCA methodology for their main products and the different models in its online portfolio. Those reports can be found under Apple's environment section but are not shown or linked during the actual purchasing process of the products.

The reports are prepared in accordance with ISO 14040 and ISO 14044. The environmental footprints exclusively provide figures concerning climate change, measured in CO₂-equivalents. They cover the entire life cycle of Apple products, based on the US configuration of the model at launch. The product life cycle is not specific to e-commerce applications, as it portrays an average product life cycle in the US. The reports additionally provide improvements compared to previous models, shares of recycled materials per product, energy efficiency figures, responsible packaging, use of chemicals and materials, and additional qualitative information regarding the environmental performance. It also disaggregates the contributions per life cycle stage to the total environmental impacts. For the iPhone 13 Pro Max, for example, the emissions from production cause 80% of the total life cycle carbon emissions, whereas transport only contributes 4%. This shows the significance of the environmental footprint stemming from the manufacturing stage of products.

To harmonise the environmental footprinting of the European Commissions (EC), Product Environment Footprint Category Rules (PEFCRs) are being developed for specific product groups. The main goal of PEFCRs is to reduce the resources needed to conduct harmonised and thus comparable product environmental footprints (PEF) based on LCA methodology. Currently, 19 PEFCRs exist – with more being under development¹⁵⁰. PEFCRs include guidance on which life cycle stages should be covered in the assessment, including downstream transportation and default losses in the supply chain. Since returns and destruction are increased for e-commerce retail, it should be reflected in the default rate for losses – which is currently not the case. The lack of distinguishing clearly between online and offline retailing is shown in the example in Box 1, where the product LCAs for Apple are based on average configurations of the supply chain and not explicitly adapted to e-commerce.

There are also two Organisational Environmental Footprint Sector Rules (OEFSRs) that aim to make the entire organisations' environmental footprints comparable. One OEFSR of high relevance for e-commerce is the Retail OEFSR, which specifies the rules for conducting an organisational environmental footprint (OEF) for retailers¹⁵¹. The retail OEFSR addresses all retail activities for the sale of products and services for the retailer's partial or full product portfolio, including the full life cycles of the products sold¹⁵². Interestingly, the representative organisation in the OEFSR is an online retailer, providing both in-house and out-of-house products. The system boundary assessed in this OEFSR is depicted in Figure 13.

¹⁴⁹ Apple, 2022, *The products you love also love the planet*. Available at: <https://www.apple.com/environment/>.

¹⁵⁰ European Commission, 2021, *Results and deliverables of the Environmental Footprint pilot phase*. Available at: https://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm.

¹⁵¹ Ibid.

¹⁵² Quantis, 2018, *Organisation Environmental Footprint Sector Rule (OEFSR) Retail*. Available at: https://ec.europa.eu/environment/eussd/smgp/pdf/OEFSR-Retail_15052018.pdf.

Figure 13: System boundaries for the organisation assessed in the OEFSR for Retail¹⁵³

Source: Quantis, 2018, Organisation Environmental Footprint Sector Rule (OEFSR) Retail.

The retail OEFSR specifies that the assessment shall cover the entire products portfolio provided for sale by the retailer – or a sub-set of the latter. If only a sub-set is covered, this shall be clearly stated in the study¹⁵⁴. This means that an online retailer selling 1st and 3rd party products shall include its entire product portfolio, and if only a part is included – this must be communicated clearly. A specific chapter on e-commerce (Chapter 6.4.1 in the OEFSR Retail) specifies the rule for correctly accounting for additional distribution impacts caused by e-commerce. For example, the rules concern accounting for product-take backs, resulting in multiple cycles through logistics-, retail-, and distribution stages, before entering the use phase¹⁵⁵. The OEFSR, as mentioned earlier, is not meant for comparative assertions, hence cannot be used to compare the environmental footprints of retailers of different retail channels.

The application of the LCA approach to calculate the environmental impacts of products or organisations differs between retailers of new products and retailers of second-hand products. It is becoming increasingly common for second-hand retailers to communicate how much environmental impact is ‘avoided’ by purchasing reused or refurbished products^{156 157}. For such calculations, the environmental impacts of refurbishing a used product is subtracted from the product-level LCA impacts of a new product to obtain the avoided emissions per product¹⁵⁸ – which can also be scaled to the organisational level¹⁵⁹. Important to understand is that avoided impact refers to the avoided emissions compared to the hypothetical scenario that a new product would have been purchased instead. In reality, purchasing second-hand products still causes additional emissions – only less than the alternative new product. Since no impacts are directly removed from nature when buying second-hand, one should be careful with communicating about avoided impacts in this context.

Even though this approach does not clearly fall under the LCA approach, it nonetheless makes use of results obtained by previous scientific LCA studies. It presents those in a more favourable way - to distinguish the benefits of their business models from a classical e-commerce retailer. Box 2 and 3 provide examples of the avoided emissions approach by second-hand retailers such as Backmarket and Marktplaats.

¹⁵³ Ibid.

¹⁵⁴ Ibid.

¹⁵⁵ Ibid.

¹⁵⁶ Available at: <https://www.backmarket.de/de-de>.

¹⁵⁷ CE Delft, 2019, *The environmental benefit of Marktplaats trading*. Available at: <https://cedelft.eu/publications/the-environmental-benefit-of-marktplaats-trading/>.

¹⁵⁸ Available at: <https://www.backmarket.de/de-de>

¹⁵⁹ CE Delft, 2019, *The environmental benefit of Marktplaats trading*. Available at: <https://cedelft.eu/publications/the-environmental-benefit-of-marktplaats-trading/>.

Box 2: Avoided environmental impacts in electronics – the example of Backmarket

Backmarket, a retailer of refurbished consumer electronics, portrays ‘avoided’ environmental impacts to the consumer when purchasing a refurbished item. It specifies avoided CO₂ emissions, avoided water use, and avoided raw materials (rare earth metals) per purchased smartphone, based on an independent LCA study conducted by the Agence de l’Environnement et de la Maitrise de l’Energie (ADEME). The study quantifies the environmental footprint of a new smartphone as 87 kg CO₂-equivalents, 548 bath tubs of water, and 381 kg of raw materials. By subtracting the emissions, water use, and raw materials of the refurbishing process, this approach avoids environmental impacts per smartphone purchased. The avoided impacts only apply to an average smartphone – not to other consumer electronics sold on the website. For all products in the product portfolio, the mass of avoided electronics waste is provided on the product page during the shopping process, which is based on the weight of each product minus exchanged parts^{160;161}.

Box 3: Avoided environmental impacts in multiple sectors – the example of Marktplaats

Marktplaats started as an online C2C trading platform in the Netherlands, now also offering new products from commercial retailers. Marktplaats commissioned a study on estimating the climate change impact reduction realized by P2P trading on its website. The methodological approach includes the life span extension achieved for different product groups (electronics, furniture, clothing, children and babies) due to reuse. Further, it calculates the avoided impact with publicly available LCA studies on the (average) carbon footprint of those product groups’ manufacturing and end-of-life treatments. By extrapolation with yearly sales, the estimated avoided climate change impact for the entire organisation of Marktplaats is calculated^{162;163}.

e. Corporate footprinting approaches are commonly used in industry to report on the environmental performance of organisations in e-commerce

The most commonly used approach in the commercial sector is corporate footprinting. This comes natural to the fact that large corporates are legally required to disclose environmental performance figures, due to the Non-Financial Reporting Directive (NFRD)¹⁶⁴. Corporate footprints are usually calculated with help of non-binding reporting frameworks, which provide standardized frameworks on how to calculate corporate environmental footprints.

Most commonly used frameworks are the GHG Protocol¹⁶⁵, the ISO 14064 standard¹⁶⁶, the Global Reporting Initiative (GRI)¹⁶⁷, and others. The GHG Protocol refers to a family of greenhouse gas accounting standards, such as the GHG Protocol Corporate Accounting and Reporting standard¹⁶⁸. The GHG protocol aims to help organisations report on their corporate carbon footprint for scope 1 (emissions from direct operations), scope 2 (indirect emissions from purchased energy), and scope 3 (emissions from indirect sources up- and downstream). The GHG Protocol provided the foundation for

¹⁶⁰ Available at: <https://www.backmarket.de/de-de>.

¹⁶¹ Backmarket, 2022, *Man kann über Nachhaltigkeit sprechen. Oder mit ihr telefonieren*. Available at: <https://www.backmarket.de/de-de/e/tech-impact>.

¹⁶² Available at: <https://www.marktplaats.nl/>.

¹⁶³ CE Delft, 2019, *The environmental benefit of Marktplaats trading*. Available at: <https://cedelft.eu/publications/the-environmental-benefit-of-marktplaats-trading/>.

¹⁶⁴ European Commission, *Corporate sustainability reporting*, Available at: https://ec.europa.eu/info/business-economy-euro/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.

¹⁶⁵ Available at: <https://ghgprotocol.org/>.

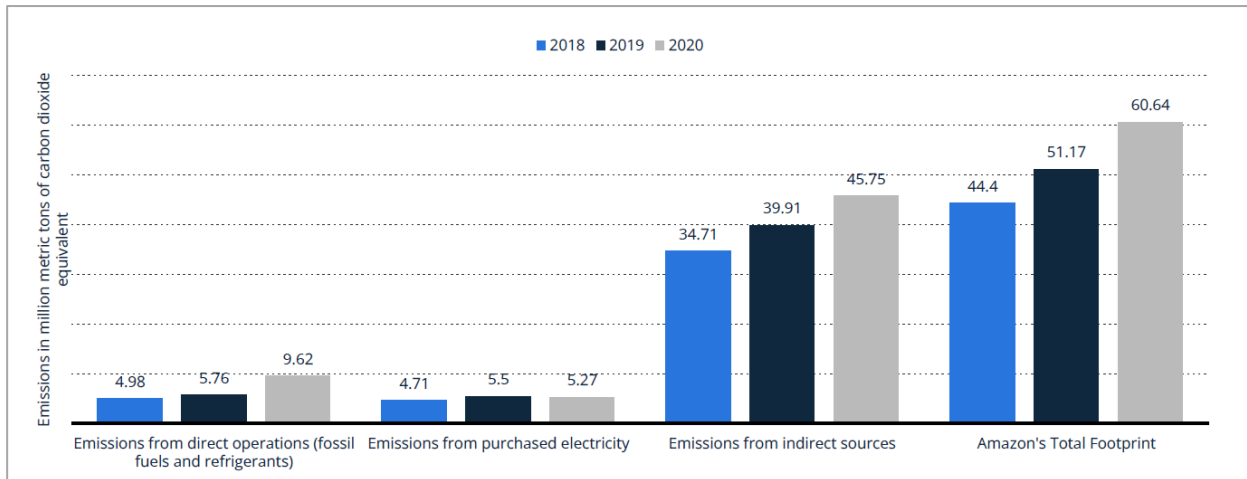
¹⁶⁶ ISO, 2018, *Greenhouse gases, Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*. Available at: <https://www.iso.org/standard/66453.html>.

¹⁶⁷ Available at: <https://www.globalreporting.org/>.

¹⁶⁸ Available at: <https://ghgprotocol.org/>.

ISO 14064, which provides guidelines for quantifying, monitoring, reporting, and verifying GHG emissions of organisations. The GRI standards provide guidance for how companies are to report on economic, environmental, and social performance. Figure 14 presents an example of the corporate carbon footprint of Amazon from 2018-2020¹⁶⁹.

Figure 14: Corporate carbon footprint of Amazon, year 2018-2020¹⁶⁹



Source: Statista, 2021, Sustainability in e-commerce.

The form and structure of providing corporate environmental information is uneven among companies, and the form in which Key Performance Indicators (KPIs) are to be provided is not clarified – which undermines the practical usability of the resulting reports¹⁷⁰. Further, some companies provide the information in their annual report (60% of the assessed reports), while some prefer separate reports (40%)¹⁷¹. Hence, the location of relevant information, the framework for assessment, and the structure of presenting the information differ between companies. The reports are often lengthy and technical, difficult to understand from a consumer perspective. Environmental topics most covered are climate change (90.9%), the use of natural resources (73.1%), polluting discharges (60.8%), waste (88.1%), and biodiversity and ecosystem conservation (36.1%)¹⁷². The public provision of corporate carbon footprints due to those assessments is the most common.

The disclosed environmental data is on the corporate level and could, in theory, inform about the environmental footprint of e-commerce players but does not directly inform the consumer’s product choice. Further, non-binding reporting frameworks, such as the GHG protocol, need to incorporate a certain level of flexibility to apply to any company in the sector. This level of flexibility, which creates advantages for practical application, also creates the disadvantage that reproducibility and comparability across companies and sectors may not be guaranteed. Box 4 and 5 present examples of the practical application of corporate environmental footprinting by Amazon and UPS, respectively.

¹⁶⁹ Statista, 2021, *Sustainability in e-commerce*. Available at: <https://www.statista.com/topics/8200/sustainability-in-e-commerce/#dossierKeyfigures>.

¹⁷⁰ The Alliance for Corporate Transparency, 2019, 2019 Research Report. An analysis of the sustainability reports of 1000 companies pursuant to the EU Non-financial Reporting Directive. Available at: https://www.sustentia.com/wp-content/uploads/2020/07/2019-Research-Report-Alliance-for-Corporate-Transparency_compressed.pdf.

¹⁷¹ Ibid.

¹⁷² Ibid.

Box 4: Corporate footprinting in delivery services – the example of UPS

UPS¹⁷³ discloses its sustainability performance annually in accordance with the standards of the Global Reporting Initiative (GRI). UPS reports on corporate energy consumption, water consumption, GHG emissions, and the volumes and management of waste. The methodology used to calculate the energy consumption is currently not explained in the report, while water is not identified as a materiality issue for the stakeholder and thus only portrays a perspective. The GHG emissions are disclosed per scope, based on LCA methodology, in line with the GHG Protocol. The resulting corporate carbon footprint is presented as net global CO₂ emissions.

Based on the assessment, UPS provides the carbon intensities (in CO₂-equivalents) per package delivered by 1) only ground operations in the US, by 2) air globally, and 3) for the US supply chain and freight. Within scope 3, upstream emissions stemming from waste generated and treated in the US are included, while downstream emissions include global waste treatment of UPS-branded packaging.

The average figures of carbon intensities per package delivered can be useful for providing quantified impacts of various delivery options. An interesting note, however, has been made in previous studies¹⁷⁴, arguing that the GHG intensities per parcel calculated by courier services are, on average larger than figures used in scientific studies because not all parcels delivered by courier companies are related to e-commerce. Fast-Moving Consumer Goods (FMCGs) are usually located relatively close to consumers. At the same time, for other non-e-commerce related items, the delivery distance can be much longer, which increases the average GHG intensities per parcel.

Box 5: Corporate carbon footprint in multiple sectors – the example of Amazon

Amazon is a first-and third-party retailer and also offers refurbished items in *Amazon Renewed*¹⁷⁵ (available for some countries only). Amazon has a large amount of information about corporate sustainability on their website. Amazon developed five quantitative models¹⁷⁶ to calculate the carbon footprint on corporate level. Those five models cover the topic areas of 1) Finances, 2) Transport, 3) Electricity, 4) Packaging, and 5) Amazon-branded products. The assessment models make use of LCA methodology and are conducted in alignment with the GHG Protocol and the ISO14064-3. The corporate carbon footprint is measured as CO₂-equivalents and presented for scope 1, 2, and 3.

The fifth calculation model calculates the environmental impacts of Amazon-branded products across the entire lifecycle. It excludes 3rd party-seller products due to being outside of Amazon's operational control. However, the share of paid units of 3rd party sellers constituted 56% of Amazon's annual sales in 2021¹⁷⁷. Even though the carbon footprints of the entire life cycle of Amazon-branded products are calculated in the 5th model, the underlying data is neither publicly available to the consumer, nor portrayed during the shopping process.

¹⁷³ UPS, 2021, 2020 GRI Content Index. Available at: https://about.ups.com/content/dam/upsstories/assets/reporting/sustainability-2021/2020_UPS_GRI_Content_Index_081921v2.pdf.

¹⁷⁴ Shahmohammadi, S., et al., 2020, Comparative Greenhouse Gas Footprinting of Online versus Traditional Shopping for Fast-Moving Consumer Goods: A Stochastic Approach. *Environmental Science and Technology*, 54 (6), pp. 3499–3509. Available at: <https://doi.org/10.1021/acs.est.9b06252>.

¹⁷⁵ Available at: <https://www.amazon.de/Zertifiziert-Generalueberholt/b?ie=UTF8&node=10676131031>.

¹⁷⁶ Amazon, 2022, *Carbon Methodology: Reaching Net Zero by 2040*. Available at: <https://sustainability.aboutamazon.com/carbon-methodology>.

¹⁷⁷ Statista, 2022, *Share of paid units sold by third-party sellers on Amazon platform from 2nd quarter 2007 to 2nd quarter 2022*, Available at: <https://www.statista.com/statistics/259782/third-party-seller-share-of-amazon-platform/>.

3.1.3. Industry-led initiatives commonly use issue-specific approaches to portray environmental information of products for specific environmental issues to the consumer

Issue-specific approaches are mainly developed and applied by industry and the commercial sector. The approaches aim to inform the consumer regarding product performance in a specific environmental issue. They usually focus on creating easy-to-understand claims regarding a specific issue, such as a product being climate neutral, energy efficient, using certified resources, and others. The products usually must conform to specific criteria to receive a certificate or a label. The methods can sometimes build upon approaches based on standardised methodologies such as LCA but further aim at communicating the performance in a simple, easy, and comparable way to the consumer. Issue-specific approaches have been divided into sustainability certificates and product (group)-specific indices.

f. Sustainability certificates certify improved performance in specific environmental issues

Sustainability certification includes private or public sustainability standards that share the intention to implement more sustainable practices in business and simultaneously enable more sustainable consumption. Companies can obtain certificates by complying with various criteria, usually audited by a third-party¹⁷⁸, to then certify their product and thereby inform the consumer. They indicate improved performance of a product compared to an average case. Sustainability certifications with growing adoption are, for example, the Forest Stewardship Council (FSC), the Marine Stewardship Council (MCS), UTZ, and Rainforest Alliance, which are used in over 170 countries with over 10,000 companies applying those certificates.

The increased uptake and simultaneous certificate expansion has led to a foggy field for businesses, stakeholders, and consumers¹⁷⁹. Currently there are over 264 active Voluntary Sustainability Standards (VSS)¹⁸⁰ and approximately 457 ecolabels¹⁸¹, here simply called certificates. An oversaturation of certificates, however decreases the credibility from the consumer's perspective. Each certificate and label usually certifies a separate issue, such as a product being carbon neutral through carbon offsets, organic, ecological etc. Some certificates have a broader scope, such as the B-Corp Certification certifying the highest standards of overall social and environmental performance, public transparency, and legal accountability of a company¹⁸². It is impossible to summarize methodological approaches for each certificate due to the sheer volume. Box 6 and Table 3 provide examples of the certification schemes currently used by Amazon.

¹⁷⁸ Amundsen, V. S., 2022, *From checking boxes to actual improvement: A new take on sustainability certification*. *Aquaculture*, 548, 737672. Available at: <https://doi.org/10.1016/j.aquaculture.2021.737672>.

¹⁷⁹ Jellema, S. F., et al., 2022, *Questioning Impact: A Cross-Disciplinary Review of Certification Standards for Sustainability*. *Business & Society*, 61 (5), pp.1042–1082. Available at: <https://doi.org/10.1177/00076503211056332>.

¹⁸⁰ UNCTAD, 2022, *Voluntary Sustainability Standards*. Available at: [https://unctad.org/topic/trade-analysis/voluntary-sustainability-standards#:~:text=Voluntary%20Sustainability%20Standards%20\(VSS\)%20are,methods%2C%20as%20well%20as%20transportation](https://unctad.org/topic/trade-analysis/voluntary-sustainability-standards#:~:text=Voluntary%20Sustainability%20Standards%20(VSS)%20are,methods%2C%20as%20well%20as%20transportation).

¹⁸¹ Ecolabel Index, 2022, *All ecolabels*. Available at: <https://www.ecolabelindex.com/ecolabels/>.

¹⁸² Bcorcopartion, 2022, *Make Business a Force For Good*. Available at: <https://www.bcorporation.net/en-us/>.

Box 6: Sustainability certification in multiple sectors – the example of Amazon

Amazon has implemented an overarching certification scheme to indicate more sustainable products, namely the “Climate Pledge Friendly” certification¹⁸³. The “Climate Pledge Friendly” certification seems to only exist in certain geographies, such as in the German web shop. A product with the “Climate Pledge Friendly” certification in the German web shop, does not seem to have the same label in the Dutch web shop (Example: Greenzla Reusable Make-up Removal Pads). To be considered eligible for this label, a product must *either* hold one of 36 eligible official sustainability certifications *or* Amazon’s own “Compact by Design” certification (a few examples are given in Table 3). The official sustainability certifications eligible also seem to differ per country website. “Compact by design”, Amazon’s own label, marks products that have a more efficient design than a baseline, using less air and water, and thus require less packaging and can be shipped more efficiently (concretely, have a higher efficiency per unit). To measure the efficiency per unit, Amazon calculated per-unit efficiency benchmarks¹⁸⁴ for various items in product categories. If the product efficiency is better than the baseline, it qualifies for the “Compact by Design” label and is eligible to receive the “Climate Pledge Friendly” certification.

All products of the Amazon Aware programme, part of the “Climate Pledge Friendly” initiative, have a “carbon neutrality” certificate, certified by ClimatePartner¹⁸⁵ – one of the official certificates listed in Table 3. The assessment covers all CO₂ emissions stemming from the product's life cycle (excluding its use). Each certified product has a certification ID, which can be traced transparently on the website of ClimatePartner. After redirection, it shows a certification that the carbon footprint has been calculated and verified, that the carbon emissions have been offset, and in which project. It is unclear if the calculated carbon footprint is based on primary data of the actual producer or an average product of the product category. Neither the methodology used by ClimatePartner, nor the footprint value of the actual product is visible to the consumer (or it is not easily retrievable).

¹⁸³ Available at: <https://www.amazon.de/b?node=22423332031>.

¹⁸⁴ Amazon, 2022, *Compact by Design Category Threshold Values*. Available at: [https://m.media-amazon.com/images/G/01/Wisp/landing-page/compact-by-design/5_31_Update/Compact By Design Kategorieschwellenwerte_5_31_DE.pdf](https://m.media-amazon.com/images/G/01/Wisp/landing-page/compact-by-design/5_31_Update/Compact_By_Design_Kategorieschwellenwerte_5_31_DE.pdf).

¹⁸⁵ Climate Partner, 2022, *Embed a holistic climate action strategy in your organization*. Available at: <https://www.climatepartner.com/en>.

Table 3: Selected examples of Amazon's eligible certificates for Climate Pledge Friendly label

Certificate	Issue
Blauer Engel	Guarantees that a product meets high standards, including protecting consumer health.
Carbonfree Certified	Determines that the CO ₂ footprint of the product and the associated CO ₂ emissions are offset with reduction projects.
Carbon Neutral by Carbon Trust	Reduce their carbon footprint year after year and the outstanding emissions are offset.
Climate neutral by ClimatePartner	Confirms that the product's carbon footprint has been calculated, continuously reduced and the remaining emissions offset.
Compact by Design	Products remove excess air and water, reducing the carbon footprint of shipping and packaging
Cradle to Cradle Certified	Made with safer materials and responsible processes to make a positive impact on people and our planet.
Energielabel	Certifies the energy efficiency of the product.
EU Ecolabel	Certifies that the product meets standards that can reduce the environmental impact in one or more life cycle phases.
EU Organic	Certifies that the product contains no or minimal amounts of chemical pesticide or fertilizers, supports animal welfare and complies with standards related to non-GMO products.
Fairtrade International	Certifies that products are made in accordance with ethical and environmental standards.
Forest Stewardship Council (FSC)	Certifies products that support responsible forest management and help keep forests healthy for future generations.
Global Organic Textile Standards (GOTS)	Certifies every step of the ecological textile supply chain according to strict ecological and social standards.
Rainforest Alliance	Certifies more sustainable farming practices that help improve farmer livelihoods and mitigate climate change.

Source: Amazon, 2022.

g. Indices aggregate the footprint of a product or product group for several environmental issues for comparative assertion

This approach aims to provide aggregated and comparable information on the consumer's environmental performance of specific products or product groups. The difference to the certification approach is that indices usually aggregate more environmental impact categories than only a single issue. Indices are often industry-specific and developed in collaboration with research and industry to give the consumer a comprehensive overview of how one product compares to another.

Indices can be based on various methodologies; often with a life cycle perspective, however, they include the additional step of transforming complex results into a comprehensive index labelling. They serve the purpose of carrying complex information in an easily digestible way as one index, which the consumer can use to compare alternatives during the shopping process. Two levels of environmental information can be exhibited through indices: the environmental impacts of differentiated products within a category (e.g. local vs imported) or the difference between product categories (e.g. animal- vs

plant-based)¹⁸⁶. The extent to which indices can carry information on both levels has been identified as a major issue¹⁸⁷. Boxes 7 and 8 show examples of the Higg Index used in the textile industry, by the example of H&M, and the eco-score in the food industry, by the example of Carrefour.

Box 7: The Higg Index in fashion & accessories – the example of H&M

H&M's own sustainable products belong to the umbrella initiative Conscious Choice¹⁸⁸. This indicates that the products are made from at least 50% sustainable materials – either biological or recycled (apart from cotton, which due to quality reasons can only be 20% recycled). The consumer can see the material composition of each product during shopping, and then a specification of the recycled content.

H&M states that it evaluates the environmental impacts of its materials using LCA data. Among others, they use the Higg Material Sustainability Index (MSI)¹⁸⁹, developed by the Sustainable Apparel Coalition (SAC). The Higg Index is part of the sustainability measurement tools developed by the SAC, to understand the costs, benefits, and trade-offs of different materials for apparel and footwear. This index uses LCA-based methodology to evaluate the environmental impacts of a product covering the impact categories of global warming, water pollution (eutrophication), water scarcity, abiotic resource depletion (use of fossil fuels) and chemistry, in comparison to an average baseline for a product group (such as an average t-shirt). The application of the Higg Index has only been piloted by H&M for some products¹⁹⁰. The Higg Index itself has recently faced major criticism¹⁹¹ (e.g. due to the cradle-to-shop focus of the environmental impacts), likewise the application by H&M¹⁹².

¹⁸⁶ Hélias, A., et al., 2022, *Implementing environmental labelling of food products in France*. The International Journal of Life Cycle Assessment, 27(7), pp. 926–931. Available at: <https://doi.org/10.1007/s11367-022-02071-8>.

¹⁸⁷ Ibid.

¹⁸⁸ Available at: https://www2.hm.com/de_de/damen/nachhaltigkeit/our-products.html.

¹⁸⁹ Higg, 2021, *Higg Materials Sustainability Index (Higg MSI)*. Available at: <https://howtohigg.org/higg-msi/>.

¹⁹⁰ Available at: https://www2.hm.com/nl_nl/kinderen/shop-op-kenmerk/9333-higgindex-kids-info.html.

¹⁹¹ Norwegian Consumer Authority, 2022. *Misleading marketing towards consumers using Higg MSI data*. Available at: <https://www.forbrukertilsynet.no/wp-content/uploads/2022/06/norrone-potentially-misleading-environmental-claims-in-marketing-using-higg-msi-data-in-marketing-of-garments.pdf>.

¹⁹² The Science Times, 2022, *H&M Published and Removed Higg Index Environmental Scorecard After Quartz Called It Out for Misleading Data*, Available at: <https://www.sciencetimes.com/articles/38478/20220630/h-m-published-opposite-result-higg-index-environmental-scorecard-quartz.htm>.

Box 8: The Eco-Score used in groceries – the example of Carrefour

Carrefour is one of the biggest food retailers in Europe¹⁹³, and also delivers its products to people's homes. In 2021, Colruyt, Lidl and Carrefour piloted the use of the Eco-score¹⁹⁴, an environmental index for all food products – covering 1st party and 3rd party brands. The Eco-score visually reminds of the Nutri-score with scores from A to E. The Eco-score was developed by a group of independent actors based on the LCA database Agribalyse. The Eco-score assesses the environmental footprints for the entire life cycle of a product. The methodology behind the Eco-score is publicly available¹⁹⁵.

The baseline assessment is based on LCA and covers 13 impact categories. The impacts are calculated per product type, hence representative over entire product groups. The LCA result is presented as a score - the lower the score, the higher the impact. On top of this baseline score, additional indicators capture other environmental issues currently not covered by LCA. The additional indicator measurements are product-specific (such as sustainability labels, packaging, origin, endangered species), which are said to enhance the comparability within product categories. Good performance in those categories receives bonus points, while bad performance leads to subtraction. Those bonus points are cumulative, up to a limit of 25 points.

The Eco-score can be applied to products but also to recipes, restaurants, packaged meals, and home meal delivery, with slight adaptations to the methodology and indicators. After the calculations, the baseline LCA score and the additional indicators score are added up to determine the final eco-score out of 100, and is lastly assigned to the associated letter.

3.2. Scientific soundness of approaches deviates from their practical application

This section analyses the scientific soundness of the presented approaches for calculating the environmental footprint of e-commerce. The evaluation is based on six criteria that are found to be vital for ensuring scientific soundness. The criteria and their explanations are presented in Table 4. The evaluation is only to be understood for the aim of soundly quantifying the overall environmental footprint arising from e-commerce and is not attempting to evaluate the soundness for other applications. It is an attempt to semi-quantitatively evaluate and compare relevant qualitative criteria and by no means portrays absolutes.

¹⁹³ Retail Index, 2022, *Food Retailers in Europe and worldwide*. Available at: <https://www.retail-index.com/sectors/foodretailersineuropeandworldwide.aspx>.

¹⁹⁴ Available at: <https://www.carrefour.com/en/actuality/carrefourecoscore>.

¹⁹⁵ Available at: <https://docs.score-environnemental.com/>.

Table 4: Criteria for the evaluation of scientific soundness

Nr.	Criterion. The assessment...	Explanation
1	... is based on internationally recognized methodologies or standards or established by public authorities.	Approaches based on accepted international methodologies and/or standards are more reliable compared to e.g. in-house developed approaches.
2	... is third-party verified.	A third-party verification is an important step to ensure that the information provided is reliable, credible and correct
3	... is based on life cycle thinking and covering the full life cycle.	To ensure that no (un)intentional burden shifting across life cycle stages occur, it is important to evaluate if the approach is based on a full life cycle.
4	... covers a wide range of environmental indicators, beyond climate change (CO ₂ -equivalents).	Climate change impact is undoubtedly a key concern, but in order to avoid burden shifting across different environmental dimensions, a comprehensive environmental assessment relies on the coverage of a wide range of environmental indicators.
5	... addresses specific aspects for the e-commerce context (e.g. packaging, logistics, returns)	Approaches that do not cover those aspects that are identified as specifically relevant to the context of e-commerce may provide incomplete information and may not point to the right actions.
6	... is transparent and underlying data are easily accessible.	Transparency and traceability of data used is a key driver to trust the information provided.

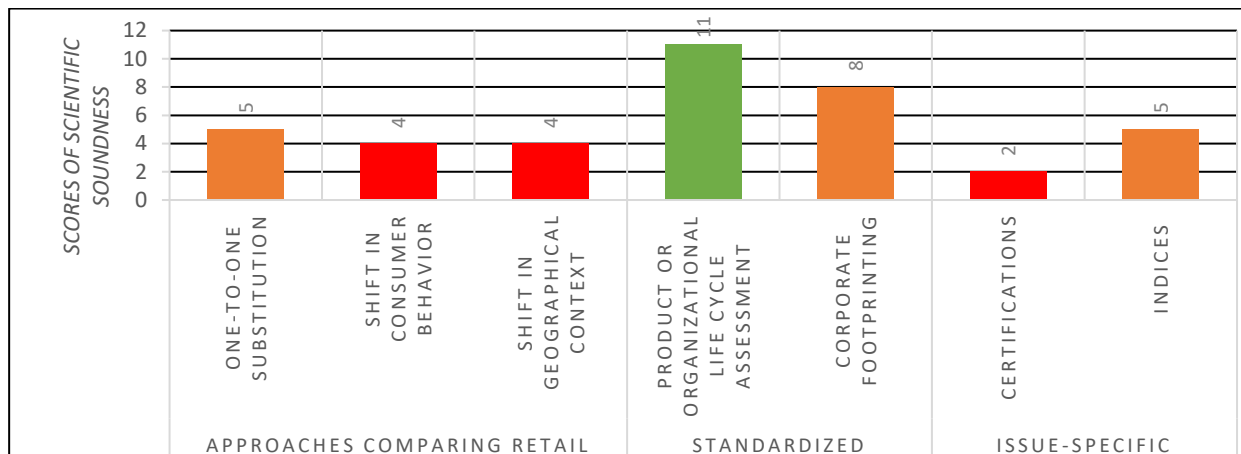
Source: PRé Sustainability.

In Chapter 3.1, it became clear that in many cases the practical application deviates from the theory of the approach. Therefore, not only the approaches should be evaluated for scientific soundness, but also their practical application. We follow a two-step methodology to provide a meaningful evaluation of 1) the scientific soundness of the approaches, 2) scientific soundness of the applications, in relation to the relevant approach. Annex 1 provides a detailed description of the methodology.

3.2.1. The approaches show a high variability in the scientific soundness

Overall, the approaches are predominantly found to be insufficiently sound to calculate the environmental footprint arising from e-commerce. Figure 15 shows the scores of scientific soundness achieved per approach.

Figure 15: Scientific soundness scores of approaches (rounded values)



Source: PRé Sustainability

0 – 4 pts (red): insufficient scientific soundness
 5 – 8 pts (orange): partial scientific soundness
 9 – 12 pts (green): sufficient scientific soundness

Most approaches score at and below 5 points (of max. 12 pts.). Specifically, the approaches comparing retail channels (av. 4 pts.) and the issue-specific approaches (av. 4 pts.) score lower than approaches based on standardised methodologies (av. 10 pts.). The following sections describe the results per approach.

Approaches comparing retail channels

Approaches comparing retail channels do not address criteria 1-3 (being based on internationally recognised methodologies, third-party verified, and covering the full life cycle). The studies do not coherently follow harmonised methodologies, and do not undergo third-party verifications apart from peer reviews. The studies mostly use emission factors or energy consumption to evaluate the environmental impacts associated with logistics and distribution, excluding the life cycles of the purchased products or services.

Only one study addresses criterion 4 (covers a wide range of environmental indicators beyond climate change), and then only partially by evaluating the impact on land use and traffic. Criteria 5 and 6 (addressing specific aspects of e-commerce and the underlying data being transparent and accessible), are fully addressed as all relevant parameters and data to evaluate the specificities of e-commerce are presented transparently in the studies.

Approaches based on standardised methodologies

Approaches based on standardised methodologies achieve higher scientific soundness than the other approaches. They are based on internationally recognised methodologies such as ISO frameworks, are third-party verified, and the underlying data is easily accessible and transparent (criteria 1, 2, and 6).

LCA approaches are based on life cycle thinking and aim to cover the full life cycle (criterion 3). On the other hand, corporate footprinting approaches often provide flexibility in defining the scopes to be included (scope 1, 2, and 3), meaning that it is not required to include the entire life cycle of products and services offered by the organisation. In contrast, it is normally required to include the impacts of the organisation as such (scope 1): an exception to this general approach is the Organisation Environmental Footprint (OEF) method, recommended by the EC, where stricter requirements on the organisational level are provided. This approach lies at the intersection of corporate footprinting and LCA approaches. Corporate footprinting approaches generally only partially address criterion 3 (except for the OEF method). In connection, LCA approaches allow to address specific aspects of e-commerce

such as additional packaging, logistics, and returns. In contrast, the corporate footprinting does not particularly require accounting for the latter (criterion 5).

Criterion 4, covering a wide range of environmental indicators beyond climate change, is where the standardised approaches may show some gaps. Even though most LCA standards encourage the coverage of many environmental indicators to avoid burden-shifting¹⁹⁶, such as the ISO 14040-44, some standards, such as ISO 14064 (Carbon Footprint of organisations) and 14067 (carbon footprint of products), exclusively focus on climate change. Most frameworks for corporate footprinting exclusively focus on GHG emissions reporting (GHG Protocol), while giving liberty to reporting on other environmental indicators. Therefore, LCA addresses criterion 4 partially, whereas corporate footprinting does not. In this context, the EF methods recommended by the European Commission (EC) (Product Environmental Footprints (PEF) and OEF) are much more prescriptive and require to report 16 environmental impact categories, ranging from climate change to water use, toxicity, eutrophication, etc.

Issue-specific approaches

Issue-specific approaches are found to be the least scientifically sound approach in the evaluation. Especially criterion 6, making underlying data easily and transparently accessible, is not addressed by many certifications schemes or specific indices.

Most certification schemes only address criteria 2 and 4, and then only partially. Some certificates require auditing processes to obtain the certificates (criterion 2), though this does not necessarily need to be a third-party verification. Some certificates cover multiple environmental issues (criterion 4), such as the B-Corp certificate evaluating the environmental impacts on climate, air, water, land, and biodiversity. Still, most of them focus on a single issue. The remaining criteria (1, 3, 5, 6) are usually not addressed by certification schemes.

Some certification schemes are internationally recognised and also supported at the national or EU level (e.g. the EU Ecolabel or the Blue Angel, the German Ecolabel) and comply with criteria 1, 2 and 6. However, they do not allow for quantifying the environmental footprint of products sold via e-commerce.

Indices partially address criteria 1-5, as they can be based on internationally recognised methodologies, can go through third-party verification, cover the entire life cycle, cover more impacts beyond climate change and address specific aspects of e-commerce. It strongly depends on the index and its underlying methodology; therefore, the criteria are addressed partially.

Key Take Aways of Scientific Soundness of Approaches

Approaches based on standardised methodologies prove to be more scientifically sound for quantifying the entire environmental footprint due to the inherent goal to cover the entire life cycle of products or organisations in e-commerce. Simultaneously, approaches based on non-standardized methodologies, like comparisons of retail channels and issue-specific approaches achieve lower scientific soundness due to meeting fewer criteria.

Some criteria are currently more often addressed than others. For example, several approaches address the accessibility of the underlying data in a transparent way (Criterion 5 and 6). While, only standardised approaches address criterion 1 and 2 (i.e. approaches based on internationally recognised methodologies and being third party verified). The least addressed criteria in all approaches are 3 and

¹⁹⁶ Burden-shifting means shifting the environmental impacts from one impact category (e.g. climate change) to another (e.g. water consumption).

4, namely, approaches that cover the full life cycle and a wide range of environmental indicators beyond climate change. This leads to the conclusion that covering the entire life cycle, i.e., including all relevant up- and downstream processes of the supply chain, and assessing more environmental indicators beyond climate change, are the shortcomings of current approaches and should be a focus for improvement on the methodological side.

3.2.2. Practical applications may deviate from the scientific soundness of approaches

Section 3.1 shows that not only the theory of the approach is relevant but also their practical application by e-commerce actors. Naturally, only approaches applied by the commercial sector can be evaluated. Hence approaches comparing retail channels are excluded from evaluating the practical applications. For the practical application, publicly available information on the approaches applied by relevant companies serve as examples. For neutrality, those companies are not named. The following sections provide examples of where practical applications show to be less compliant with the approaches.

Standardised approaches - Application of LCA in practice

While the approach recommends the inclusion of multiple environmental indicators (e.g. ISO 14044), the evaluated cases only portray the results for the environmental indicator of climate change, in line with standards with narrower scope (e.g. ISO 14067). This is allowed by the standards, but it may not be the most suitable choice to depict the overall environmental footprint, which should go beyond simple carbon footprint.

The evaluated examples do not address the specificities of e-commerce, such as accounting for additional product returns and associated packaging. They only assess a default life cycle of a product, for both e-commerce and physical retail, without considering the specificities of e-commerce if retailed online.

The underlying data is only partly transparent and accessible. The results are reported clearly, but the data used for the assessment is not. It is not clearly evident if the data is third-party verified.

Standardised approaches - Application of corporate footprinting in practice

The evaluated cases do not address specific aspects of e-commerce (criterion 4), such as accounting for product returns and associated packaging. They only account for environmental impacts arising from standard sales.

The underlying data for the assessment is not transparent or publicly accessible, as only the results of the assessments are portrayed. Still, the data used for and the scopes determining the assessment are not.

They show a flexible application of life cycle boundaries. For example, one case excludes all 3rd party-products in the portfolio assessment, and hence does not cover all products and services offered by the organisation. This may also be due to the difficulty in gathering data for 3rd party products.

Issue-specific approaches - Application of certifications

The application of certificates is identical to the approach, as it only needs to be put on the product. Hence, the applications achieve a full score (1) for conformity with its approach.

Issue-specific approaches - Application of indices

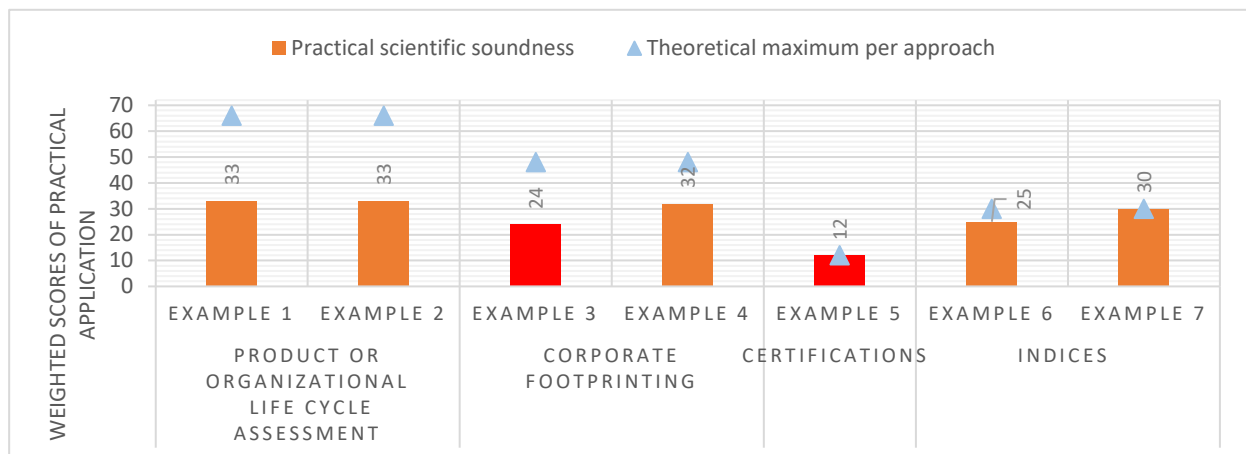
Even though the methodology itself often can be third-party verified, not all the evaluated applications are. Apart from this, the applications are in line with the approach.

Key takeaways from the evaluation of practical application

It is found that the practical application of approaches often deviates from its theory. This gap between theory and practice is larger for more scientifically sound and, thus, more complex approaches. Less scientifically sound approaches show an application that is more in line with the theory due to lower complexity. Criteria that are less addressed in practical applications are to address the specificities of e-commerce and that the underlying data is not transparently accessible.

Figure 16 presents a comparable evaluation of each practical implementation using weighting to account for both the approach's soundness and the application's soundness. Figure 16 shows the tendency that applying a scientifically sounder approach only partially is more scientifically sound than applying an insufficiently sound approach as intended. We thus see an opportunity for facilitating the application of scientifically sound approaches.

Figure 16: Weighted scientific soundness scores of practical applications based on relevant approaches (rounded values)



Source: PRé Sustainability.

0 – 24 pts (red): insufficient scientific soundness
 25 – 48 pts (orange): partial scientific soundness
 49 – 72 pts (green): sufficient scientific soundness

4. OPPORTUNITIES AND THREATS OF E-COMMERCE

KEY FINDINGS

E-commerce environmental footprint currently presents hotspots, such as logistics, over-packaging, and destruction after return.

- Logistics and transportation of goods are one of the areas in which e-commerce has caused the greatest transformation. The threats in this context predominantly involve additional CO₂ emissions caused by goods having to be returned, increased freight traffic to remote locations, and the great importance placed on fast delivery in e-commerce business models. At the same time, advancements in transport technology and business models which provide pick-up point options for consumers (replacing emissions created by delivering to individual homes) can help to reduce emissions;
- Regarding energy usage and efficiency, a significant factor affecting the environmental footprint of e-commerce is the effect that data transfers involved in online shopping have on electricity demand;
- In the context of widespread internet use, the availability of information on the internet represents an opportunity as consumers can do research and select to purchase from more eco-friendly companies. E-commerce plays a role in facilitating these purchases. Without it, such consumers are restricted to physical retail options available in their vicinity, which may only involve companies with poor sustainability models; and
- The growth of e-commerce has meant more packaging being used inefficiently without promising solutions to reduce its impact. Regarding e-commerce's impact on a product's end of life, findings suggest online platforms have allowed for the growth of the circular economy.

From a legislative perspective, there is no overarching, integrated EU policy instrument covering the sustainable production and consumption of all products nor the availability and reliability of information on these products to consumers. At the same time, when it comes to e-commerce legislation, there are still areas of synergies that could further be exploited to ensure more sustainability and circularity regarding online sales.

This chapter builds on the discussion in Chapters 2 and 3 to identify the key opportunities and threats in e-commerce for the delivery of the EU's Green Deal.

4.1. Market opportunities and threats

This section focuses on opportunities and threats for sustainability that are specific to e-commerce from a market perspective.

4.1.1. Efficiency and scale of logistics and transport

Logistics and transportation of goods is one of the areas in which e-commerce has caused the greatest transformation. It is also one of the key considerations regarding the opportunities and threats that e-commerce presents for sustainability. The threats arising in this context predominantly involve additional CO₂ emissions caused as a result of goods having to be returned, increased freight traffic to remote locations, and the great importance placed on fast delivery in e-commerce business models. At the same time, advancements in transport technology and business

models which provide pick-up point options for consumers (replacing emissions created by delivering to individual homes) can help to reduce emissions. Nonetheless, as further elaborated below, technological advancements do not appear likely to offset emissions to a great extent and consumers still prefer home delivery¹⁹⁷.

As noted in Chapter 2, e-commerce involves a greater share of returns (25-40% globally) than traditional retail (8%)¹⁹⁸. Parcel returns policies play a central role in e-commerce business models, but they also create environmental pressures. It has been estimated that the return of a non-food product purchased online causes the emission of 112 grams of CO₂ per product compared to 68 grams of CO₂ for products purchased in physical stores¹⁹⁹.

EU law allows consumers to return products purchased online within 14 days of the good being received. Additionally, free return policies are offered by some e-commerce companies as a way of encouraging consumption and growing their business. Indeed, in several sectors (particularly apparel), returns are seen as inevitable and are costed in by companies involved. For instance, it is frequently the case that buyers purchase several of the same item in different sizes to try them on at home and return the items that do not fit. This is seen as one of the main “selling points” for e-commerce businesses. For companies such as Zalando, the ease and free-of-charge return of goods is considered a core part of their business model as it ensures customer satisfaction, encouraging continued use of the platform²⁰⁰. Consequently, goods have to be transported back to their origin, entailing greater CO₂ emissions²⁰¹.

In addition, one inherent risk in logistics and transportation is the potential for the products to be damaged upon delivery. This can mean additional costs for the company itself as the good is returned and disposed of (as it cannot be sold further). Still, it can also involve environmental concerns due to waste as well as the CO₂ emissions caused by the transport of the returned goods from a drop-off location back to the company (or warehouse). While damage to goods on delivery affects both off- and online merchants, the risk is greater in e-commerce because there is more handling involved in home delivery. According to DHL, an e-commerce package is handled 20 times more frequently in the logistics network from the distribution centre to the consumer than a pallet transport to a retailer²⁰². Furthermore, fast delivery, a core part of e-commerce business models, increases the chance of damage²⁰³.

An additional threat to sustainability arising from e-commerce is the freight traffic resulting from the need to deliver products to the consumer’s home. Delivery of a parcel to a recipient’s address results in high costs (extended truck route of a courier) and greater environmental pollution (higher emissions from the trucks of transport companies). As a result, the “last mile” issue has been

¹⁹⁷ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

¹⁹⁸ LogistiscMatters, 2022, *All You Need to Know About e-Commerce Returns in Europe*. Available at: <https://logisticsmatter.com/need-know-e-commerce-returns-europe/>.

¹⁹⁹ OliverWyman, 2021, *Is e-commerce good for europe? economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-e-commerce-good-for-europe.pdf>.

²⁰⁰ Zalando, 2020, *Zalando The starting point for fashion. Investor Factbook, December 2020*. Available at: https://corporate.zalando.com/sites/default/files/media-download/Zalando%20SE%20Investor%20Factbook%202020_7.pdf.

²⁰¹ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁰² James, F., Kurian A., 2021, *Sustainable Packaging: A Study on Consumer Perception on Sustainable Packaging Options in E-Commerce Industry*, *Nat. Volatiles & Essent. Oils*, 2021; 8(5):10547-10559. Available at: <https://www.nveo.org/index.php/journal/article/view/2975/2755>.

²⁰³ Joint Research Centre., 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

regarded as one of the logistics chain's most expensive, least efficient, and most polluting sections²⁰⁴. In addition, delivery of the product to the consumer usually occurs within the standard working hours of suppliers, when customers are often away from their place of residence and hence, unable to receive the package. Repeat deliveries result in increased mileage for the logistics operator and greater emissions²⁰⁵. It has been highlighted that the problem of repeat delivery concerns about 20-30 % of recipients²⁰⁶. Additionally, repeat delivery also carries an additional risk of damage, further increasing the rate of product returns²⁰⁷.

While most of the EU population lives in non-rural areas (69.4% in 2019)²⁰⁸, shipping of e-commerce products to rural areas is projected to increase. One study indicates that in Germany, 300 million packages were shipped to rurally based consumers in 2016, which is projected to increase to 500 million by 2030^{209;210}. Regarding delivery to remote locations, longer truck journeys result in greater CO₂ emissions compared to deliveries to urban areas. While such deliveries may replace individual car trips to retail stores by consumers²¹¹, the specificities of e-commerce delivery mean several trips may have to be performed for what would be a single car ride to a retail store.

On the other hand, opportunities presented by efficient delivery can mean a lower environmental impact. In the interest of cost savings (and time pressures of fast delivery), e-commerce companies will seek to optimise deliveries to the fullest extent possible. For instance, this can involve ensuring the quickest delivery route, delivering multiple types of products from a single warehouse to replace individual shopping trips to multiple shops. The impact can also depend on the form of transportation. If a delivery replaces public transportation use for individual shopping trips, it can have a negative net impact in terms of CO₂ emissions. On the other hand, a net positive impact can be derived if deliveries are made with less environmentally impactful forms of transport such as electric or hybrid vehicles^{212;213}.

A major threat arising out of e-commerce is connected to the central role that fast delivery times play in such business models. Consumer expectations of quickly shipped products, including same- or next-day delivery, mean that e-commerce companies often have to resort to transportation methods which present a higher risk to the environment. Products that are not located in close-by warehouses

²⁰⁴ James, F., Kurian A., 2021, *Sustainable Packaging: A Study on Consumer Perception on Sustainable Packaging Options in E-Commerce Industry*, Nat. Volatiles & Essent. Oils, 2021; 8(5):10547-10559. Available at: <https://www.nveo.org/index.php/journal/article/view/2975/2755>.

²⁰⁵ Moroz, M., Polkowski, Z., 2016, The Last Mile Issue and Urban Logistics: Choosing Parcel Machines in the Context of the Ecological Attitudes of the Y Generation Consumers Purchasing Online, *Transportation Research Procedia*, Volume 16, 2016, Pages 378-393, ISSN 2352-1465, <https://doi.org/10.1016/j.trpro.2016.11.036>. Available at: <https://www.sciencedirect.com/science/article/pii/S2352146516306500>.

²⁰⁶ De Souza, R. et al, 2014, Collaborative urban logistics–synchronizing the last mile a Singapore research perspective, *Procedia-Social and Behavioural Sciences* 125, 422-431.

²⁰⁷ Mangiaracina, R, et al., 2015, *A review of the environmental implications of B2C e-commerce: a logistics perspective*, Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Milano, Italy. Available at: <https://re.public.polimi.it/retrieve/handle/11311/987082/447073/A%20Review%20of%20the%20envir>.

²⁰⁸ European Commission, *EU rural areas in numbers*. Available online: https://ec.europa.eu/info/strategy/priorities-2019-2024/new-push-european-democracy/long-term-vision-rural-areas/eu-rural-areas-numbers_en.

²⁰⁹ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²¹⁰ Mangiaracina, R, et al, 2015, *A review of the environmental implications of B2C e-commerce: a logistics perspective*, Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Milano, Italy. Available at: <https://re.public.polimi.it/retrieve/handle/11311/987082/447073/A%20Review%20of%20the%20envir>.

²¹¹ Ecommerce europe., 2021, *Collaborative Report on Sustainability and e-Commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

²¹² Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²¹³ Ecommerce Europe., 2021, *Collaborative Report on Sustainability and e-Commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

frequently have to be shipped via air transport, which is more carbon-intensive than transportation by rail or road. For bricks-and-mortar stores, fast transportation is less essential, reducing the dependence on air freight²¹⁴.

In the presence of such concerns, attempts to reduce the environmental impact have been explored, including through changes to companies' business models:

- Digital lockers, like those provided by *Easybox*, involve a parcel pick up/return system from lockers located throughout a city which customers can easily access. As it eliminates the particularly significant "last mile" issue, this particular business model can reduce carbon emissions by 20.5% compared to shipping to a customer's doorstep²¹⁵;
- The omnichannel retail model allows consumers to buy online but pick up their purchase in-store. Examples include IKEA, which has opened stores in cities for pick-up²¹⁶; and
- Several companies involved in e-commerce are seeking to incorporate electric vehicles into their deliveries. A relevant initiative in this context is the EV100, which brings together several global companies seeking to foster a widespread transition towards electric vehicles. Similarly, IKEA is seeking to have all home deliveries performed with so called "zero-emissions" transportation (e.g. electric vehicles, bikes, and rail, amongst others)²¹⁷.

Previous analysis has highlighted that the increasing use of greener forms of transport and advances in the sustainability of transportation have the potential to lower the environmental impact of e-commerce logistics. It has been estimated that delivery by truck can see greater fuel efficiency by around 30% in the next decades due to emerging alternative propulsion technologies, including those seen in electric vehicles. Additionally, emerging technology in water transportation has been estimated to allow for a 40% increase in energy efficiency by 2050 (from 2010). Nevertheless, air transport, the most polluting form of delivery, does not appear to have any promising emerging technologies which could substantially reduce current emissions²¹⁸.

4.1.2. Energy usage and efficiency in physical premises and in relation to data transfers

The rise of e-commerce offers opportunities for reduced energy usage compared with traditional retail stores. E-commerce companies require just a warehouse to store their products. In contrast, a traditional brick-and-mortar store most often requires physical space for consumers to browse and make purchases, in some cases parking space, and a warehouse. Greater physical space, in addition to occupying land, which could be green space, entails greater energy use for lighting, heating, etc. A previous study²¹⁹ has nevertheless indicated that replacing retail stores with e-commerce has a negligible effect in reducing CO₂ emissions. Another minor effect concerns the reduction of printed marketing material as a result of online shopping, which is also considered to be of minor importance in reducing the environmental effects of commerce²²⁰.

²¹⁴ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²¹⁵ Ecommerce Europe, 2021, *Collaborative Report on Sustainability and e-Commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

²¹⁶ Ibid.

²¹⁷ Ibid.

²¹⁸ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²¹⁹ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²²⁰ Ibid.

A much more significant factor affecting the environmental footprint of e-commerce is the effect of data transfers in online shopping on electricity demand. An underlying network infrastructure is needed to host and perform the e-commerce activities and transactions which requires energy use. Electricity consumption underpins data traffic, processing and storage, as well as ensuring interconnectivity with different devices. This is exacerbated by the fact that, as technology develops (allowing for greater high-speed internet) and the e-commerce market becomes more sophisticated, the services offered by online platforms become more and more data intensive. For instance, to incentivise purchases, platforms seek to provide interactive interfaces, video, audio, high-resolution photos, and virtual models, which all entail more energy use as a result of the greater data transfer needs. It has also been noted that while there is increasing energy efficiency resulting from continuously advancing technology underpinning internet infrastructure, this does not appear likely to compensate for greater demand for data as a result of more people making use of e-commerce, and increasing sophistication of platform interfaces²²¹.

4.1.3. Digitalisation: informed decision making and nudging

Digitalisation and the internet have increased the availability of information to consumers, which could positively impact their ability to make informed purchasing decisions. While information overload can be detrimental, different platforms can provide information to consumers material in condensed and digestible ways, which can help nudge them towards more eco-friendly purchasing habits²²².

Over the last 20-25 years, consumers (especially in higher-income countries) have been paying more and more attention to the environmental aspect of their consumption²²³. According to a survey carried out by IBM in 2020:

- 78% of consumers say it's at least moderately important that brands offer "clean" products;
- 77% are sustainable and environmentally responsible;
- 76% support recycling;
- 72% use natural ingredients;
- 70% of said respondents would pay an average premium of 35% for a sustainable and environmentally responsible brand; and
- 57% are willing to change their purchasing habits to help reduce the negative impact on the environment²²⁴.

Furthermore, another survey on e-commerce users indicates that only about 18% of consumers do not care about the sustainability credentials of companies they seek to purchase from²²⁵. Generally, younger generations are more environmentally conscious than older generations. For

²²¹ Ibid.

²²² Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²²³ Quoquab, F., Mohammad, J., 2020, *A Review of Sustainable Consumption (2000 to 2020): What We Know and What We Need to Know*, *Journal of Global Marketing*. 33. 10.1080/08911762.2020.1811441.

²²⁴ IBM, 2020, *Meet the 2020 consumers driving change*. Available at: <https://www.ibm.com/downloads/cas/EXK4XKX8>.

²²⁵ Internet retailing, 2022, *Online shoppers value sustainability credentials over brand loyalty, study finds*. Available at: <https://internetretailing.net/sustainability/online-shoppers-value-sustainability-credentials-over-brand-loyalty-study-finds/>.

example, 58% of Gen Z²²⁶ consumers and 61% of millennials state that they are willing to pay more for eco-friendly products compared to 55% of Gen X consumers and 46% of baby boomers²²⁷. In addition, 69% of Gen Z consumers and 70% of the millennials rent or want to rent products instead of purchasing, while the same share for Gen X consumers and baby boomers is 57% and 41%, respectively²²⁸. Similarly, 78% of Gen Z consumers and 77% of the millennials have purchased or want to purchase pre-owned, repaired, or renewed products compared to 70% of Gen X consumers and only 58% of baby boomers, indicating a considerably lower likelihood of these generations participating in the second-hand C2C online market²²⁹. Higher environmental consciousness from younger consumers compared to older consumers could lead to a generational shift towards more sustainable consumption in the future.

At the same time, these stated preferences are not always followed by actual consumption behaviour. For example, in a survey conducted over a representative sample of 2000 UK households in June 2022, Deloitte research²³⁰ reveals that although the majority of consumers recognise what makes a product sustainable, i.e. it is biodegradable (65%) or made from recycled packaging (60%) when it comes to making a purchase, consumers value durability (52%) over recyclability (23%). Moreover, the survey finds that the primary reasons for not adopting a more sustainable lifestyle are related to cost (52%), lack of interest in the issue of sustainability (51%), or not having enough information (48%). In particular, 50% of consumers are either unwilling to pay more for sustainability or are unsure whether they would, and only 25% would pay more for sustainable packaging and products. A lack of trust in the commitments made by businesses on sustainability issues contributes to this lack of willingness to pay more.

In the specific context of e-commerce, the fashion company Zalando²³¹ documents a similar attitude-behaviour gap, as shown in Figure 17. For various dimensions of sustainability, a higher share of survey respondents reports that they value this dimension than report taking it into account in their purchasing decision.

Similarly, according to an Oliver Wyman consumer study carried out in France in 2019²³², less than 10% of online shoppers show a systematic interest in the environmental impact of their online orders. One in three consumer reports is sensitive to the topic. Of those who are environmentally conscious, consumers think first about the impacts of their product choices (about 65%) and packaging (40 to 50%) and last about delivery (about 40%).

²²⁶ Definitions: Baby boomers refers to the demographic cohort between 1946-1964, Gen X refers to the demographic cohort between 1965-1980, Millennials refers to the demographic cohort between 1981-1996, Gen Z refers to the demographic cohort between 1997-2012.

²²⁷ Statista, 2022, *Share of consumers willing to pay more for eco-friendly products worldwide as of 2018, by generation*. Available at: <https://www.statista.com/statistics/1134301/consumer-willingness-to-pay-for-eco-friendly-products-worldwide/>.

²²⁸ IBM, 2020, *Meet the 2020 consumers driving change*. Available at: <https://www.ibm.com/downloads/cas/EXK4XKX8>.

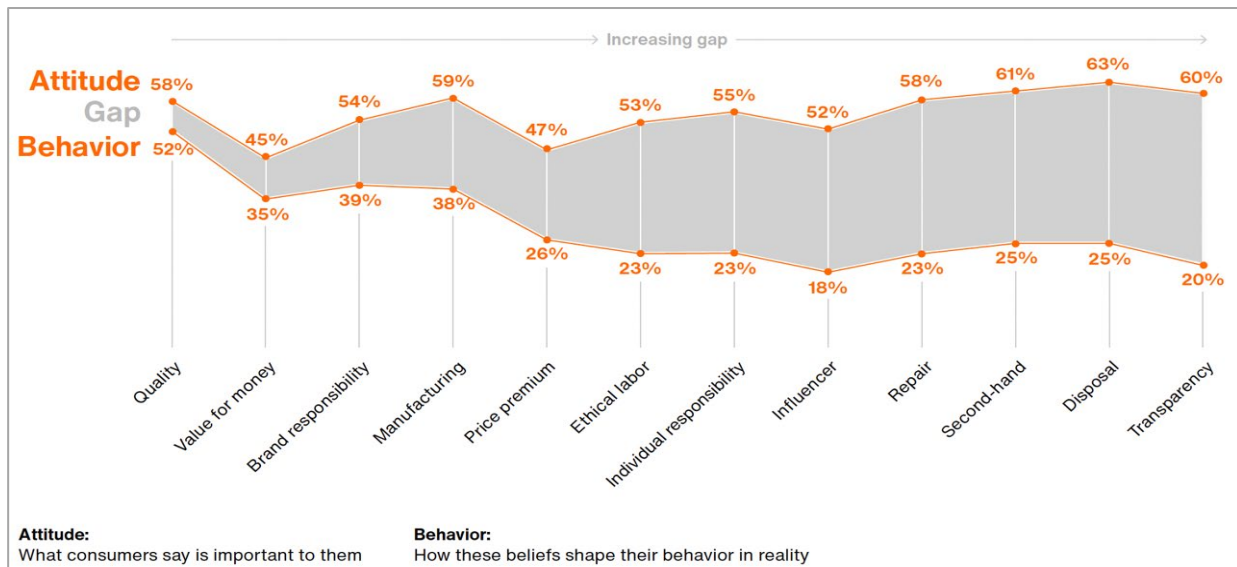
²²⁹ Ibid.

²³⁰ Deloitte, 2022, *How consumers are embracing sustainability*. Available at: <https://www2.deloitte.com/uk/en/pages/consumer-business/articles/sustainable-consumer.html>.

²³¹ Zalando, 2022, *It takes two: How the Industry and Consumers Can Close the Sustainability Attitude-Behavior Gap in Fashion*. Available at: https://corporate.zalando.com/sites/default/files/media-download/Zalando_SE_2021_Attitude-Behavior_Gap_Report_EN.pdf.

²³² Oliver Wyman, 2021, *Is E-Commerce Good For Europe? Economic and environmental impact study*. Available at: <https://www.oliverwyman.de/content/dam/oliver-wyman/v2/publications/2021/apr/is-ecommerce-good-for-europe.pdf>.

Figure 17: Results from survey of consumer attitudes and behaviour conducted by Zalando



Source: Zalando, 2022.

Nevertheless, in the context of widespread internet use, the availability of information on the internet represents an opportunity as consumers can research and select to purchase from more eco-friendly companies. E-commerce plays a role in facilitating these purchases since without it, such consumers are restricted to physical retail options available in their vicinity, which may only involve companies with poor sustainability models. At the same time, e-commerce opens the possibility of ordering products made by eco-conscious companies with a lower environmental impact. Additionally, several online platforms provide sustainability ratings on different companies, such as “good on you” which highlights to consumers the sustainability of different clothing companies^{233;234}. With the help of such platforms, informed consumers can then use e-commerce to gain access to these companies, reach beyond their local area, and purchase goods in line with their sustainability preferences.

The Digital Product Passport is another tool that, in combination with e-commerce, can inform consumers’ decision-making and push them towards more sustainable choices. This involves a product identification (such as a QR code) that different actors in the supply chain can scan to receive information about the sustainability of the product, including, for example, product materials or whether the product can be reused and recycled²³⁵. The Digital Product Passport could allow platforms to easily gather reliable information from the entire supply chain and present it to consumers. Furthermore, this information can help sustainability-oriented e-commerce platforms to differentiate themselves better and offer products in line with their focus. E-commerce platforms can also include the QR codes in the product descriptions presented online to allow consumers to compare across products. Through e-commerce, consumers can compare the Digital Product Passports across a wider array of goods.

Additionally, e-commerce platforms can use this wide library of information to incentivise consumers towards making more eco-friendly decisions when shopping online. Previous studies

²³³ UNEP, 2022, *Why you should rethink your next purchase*, available at: <https://www.unep.org/news-and-stories/story/why-you-should-rethink-your-next-fashion-purchase>.

²³⁴ Available at: <https://goodonyou.eco/about/>.

²³⁵ Euroactive, 2021, *EU plans ‘digital product passport’ to boost circular economy*. Available at: <https://www.euractiv.com/section/circular-economy/news/eu-plans-digital-product-passport-to-boost-circular-economy/>.

indicate that the most effective way of nudging consumers towards choosing the most environmentally friendly shipping option, in addition to providing information on the CO₂ emissions involved and highlighting the most sustainable choice with a green leaf icon, was to pre-select the one with the lowest carbon footprint^{236;237;238}. In one previous study, the options provided were: same-day delivery, next-day delivery, and pick-up from a collection point. These tests indicated that providing information within the online platform on the different delivery options meant consumers selected the most environmentally friendly choice twice as many times than they did without the information (from 8% to 16% of the times) while pre-selecting the most sustainable choice as the default option meant consumers were choosing this option 28.7% of the times^{239;240;241}. Another example includes Flixbus, which activated CO₂ compensation for its trips by default, at an additional cost of 1-3% of the ticket price. Presented with the payment of a modest premium as a default option, 10% of Flixbus customers agreed to pay the premium. While these figures demonstrate that sustainability is not the most salient issue for consumers, when making purchases, some consumers are willing to pay a premium for sustainability if it is easier to accept than reject it.

4.1.4. Packaging

With the rise of e-commerce, there has been a corresponding increase in the use of packaging material which presents particular risks to the environment. As highlighted by the Joint Research Centre (JRC), there are two principal considerations involved in packaging: excessive packaging and the use of secondary packaging specific to e-commerce. As regards opportunities to mitigate the impact of packaging, efforts have been placed on increasing efficiency in packaging and developing solutions to reuse packaging.

As mentioned previously, a significant share of the environmental footprint of e-commerce arises from individual packaging and last mile delivery. In addition to the primary packaging wrapping the product, in e-commerce, a secondary packaging (e.g. a cardboard box) is used to transport the good. Smaller batches delivered to the consumer result in a larger amount of packaging and waste than bulk deliveries to brick-and-mortar shops²⁴². Furthermore, compared to traditional retail shopping, studies find the environmental impact of shopping bags used by customers in this context is usually lower because it entails a comparatively limited amount of packaging²⁴³.

Another issue arising from e-commerce is the excessive use of so-called protective packaging. Companies involved in selling products through online platforms to be delivered directly to consumers need to ensure products are not damaged while transported. Damage to the product can lead to customers returning the orders, and it can lead to the products being wasted if no longer usable. The JRC notes that this protection may be against “atmospheric, magnetic, electrostatic, vibration, shock

²³⁶ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²³⁷ Ecommerce Europe., 2021, *Collaborative Report on Sustainability and e-commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

²³⁸ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²³⁹ Ecommerce Europe., 2021, *Collaborative Report on Sustainability and e-commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

²⁴⁰ Terryn, E., Van Gool, E., 2021, *The Role of European Consumer Regulation in Shaping the Environmental Impact of E-Commerce*, Journal of European Consumer and Market Law Volume 10, Issue 3 (2021) pp. 89 – 101.

²⁴¹ Available at: <https://goodonyou.eco/about/>.

²⁴² Ibid.

²⁴³ Van Loon, P., et al, 2014, *A comparative analysis of carbon emissions from online retailing of fast moving consumer goods*, Journal of Cleaner Production, doi:10.1016/j.jclepro.2014.06.060. Available at: <http://dx.doi.org/10.1016/j.jclepro.2014.06.060>.

impact, or other factors” that may arise during the product’s shipping²⁴⁴. The protective packaging can include foam, bubble wrap, padding, and others, with different packaging coming in plastic or carton. Companies need to balance the need to ensure products are protected with costs of packaging. Additionally, considerations related to packaging integration in the supply chain play an important role in the design of the packing. As a result, some deliveries include excessive protective packaging that can be considered wasteful. Furthermore, packaging is often standardised, meaning that small items that are not fragile are provided with disproportionately large boxes and packaging that provides an unnecessary amount of shock protection. It has been highlighted that such issues relate in particular to the delivery of small ICT products and to a lesser extent, clothing accessories²⁴⁵. An additional issue raised by the use of protective packaging is that for some deliveries, mixed materials of plastic (e.g. for bubble wrap) are used which often can’t be recycled or need to be recycled separately, which can also slow down or halt the recycling process^{246;247}.

Several companies have been exploring opportunities to reduce the environmental impact of packaging involved in e-commerce as part of their business policies. For instance, to mitigate the issue of inefficient secondary packaging, Zalando has introduced a ‘one parcel policy’ which bundles in a single delivery package, purchases from different brands made within one to several hours per day. Some companies are also increasingly orienting their business models towards omnichannel solutions (as noted earlier), allowing buyers to pick their online orders from physical stores where products are shipped in bulk. This avoids the secondary packaging inefficiencies inherent in delivering directly to the consumer²⁴⁸.

Furthermore, to reduce waste involved in secondary packaging, several pilot projects have been initiated to explore the possibility of using reusable delivery parcels in e-commerce. One such initiative is the RePack reusable delivery bags being tested by the companies Tchibo, Otto and Avocadostore. The project, funded by the German Federal Ministry of Education and Research, assesses how packaging can be designed economically viable, while ensuring it can be re-used by industry for deliveries. The repack delivery bags are made of recycled plastic and can be folded and returned by post – without charge to the consumer and with a deposit reward system – to be reused for deliveries up to 20 more times. In the pilot, the return rate of the packages was between 70% and 80% with and without product returns. It was furthermore estimated that the product could replace 7,500 disposable delivery bags. Nevertheless, while there is evidence that the pilot has worked on a small scale, there is concern that there would be significant logistical costs if the system were scaled up to the company or industry level²⁴⁹. Other similar pilots include LOOP being developed by Carrefour and TerraCycle (a waste recycling company), which seeks to use reusable containers instead of single-use packaging. In this case, the company also handles returns for the user, offering delivery and pickup of products while

²⁴⁴ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁴⁵ Ibid.

²⁴⁶ Chicago Tribune, 2019, *Amazon's plastic mailers are gumming up recycling operations*. Available at: <https://www.chicagotribune.com/business/ct-biz-amazon-recycling-packaging-20190211-story.html>.

²⁴⁷ Forbes, 2019, *Does E-Commerce Care About Sustainability?* Available at: <https://www.forbes.com/sites/blakemorgan/2019/11/05/does-e-commerce-care-about-sustainability/?sh=7863522912c8>.

²⁴⁸ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁴⁹ Ecommerce Europe., 2021, *Collaborative Report on Sustainability and e-commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

making use of the reusable empty packaging. LimeLoop, similarly offers reusable packaging that e-commerce companies can rent to make deliveries and which customers can return free of charge²⁵⁰.

Initiatives for collaboration between e-commerce platforms and waste management providers have also highlighted opportunities to ensure greater sustainability in e-commerce logistics, specifically regarding packaging. As discussed in conferences such as FachPack, e-commerce companies are exploring ways to integrate waste management suppliers into their logistics chain to ensure packaging employed in deliveries can be reusable and recyclable. One example of such an initiative involves Amazon's Packaging Support and Supplier Network (APASS) program, which connects packaging companies with vendors and manufacturers to ensure packaging can be optimised in this way²⁵¹.

Despite these opportunities to mitigate the threats created by e-commerce packaging, these solutions are focused on mitigation, and their positive environmental impact will likely not compensate for the additional negative impact created by e-commerce compared with traditional retail: i.e. the environmental costs of purchasing from traditional retail is likely to be significantly lower than the mitigation solutions being explored. Furthermore, while the proposed solutions may reduce the amount of packaging per unit delivery, if e-commerce continues to grow, overall demand for packaging may eliminate the gains from such initiatives²⁵².

4.1.5. End of Life and Circularity

A previous report has highlighted that e-commerce can contribute to the circular economy by allowing consumers to extend the lives of products they have previously purchased²⁵³. For example, several e-commerce companies provide a marketplace for refurbished products and second-hand clothing items. At the same time, the business models of e-commerce may present a threat due to a lack of effective take-back schemes, waste from returns, and the relatively small circular economy market compared with the overall size of e-commerce.

A prime example of how e-commerce has contributed to developing the circular economy can be found in the expansion of what is known as the 're-commerce' market or second-hand e-commerce. Currently, merchants in this space predominantly focus on fashion and electronic devices such as smartphones, with some merchants focused on used products or refurbished items. These re-commerce markets contribute to reducing waste by prolonging the life of products and lowering demand for new goods.

While a second-hand product market existed before the advent of e-commerce, online platforms have allowed this market to grow substantially. The fashion-oriented second-hand e-commerce market currently represents close to 74 billion EUR (3.5% of the total fashion industry), with some analyses projecting it to grow to around 700 billion EUR by 2030 (23% of the whole fashion industry)²⁵⁴. The emergence of companies dedicated to meeting this demand has helped expand accessibility and

²⁵⁰ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁵¹ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁵² Ibid.

²⁵³ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁵⁴ Lizee Blog, 2022, *Why should brands and retailers embrace re-commerce in 2022?*. Available at: <https://www.lizee.co/blog/why-should-brands-and-retailers-embrace-re-commerce-in-2022#:~:text=Re%2Dcommerce%20currently%20represents%20a,times%20faster%20than%20standard%20retail.>

institutionalise the markets. The latter, along with rating systems embedded in the platforms, has provided consumers with confidence in the reliability and security of these platforms²⁵⁵. An example of a dedicated platform in this area is Vinted which is focused on selling second-hand clothing. Other companies, such as Zalando, have also introduced second-hand products into their business models.

Similarly, e-commerce has fostered the growth of “aftermarkets” where consumers can purchase spare parts used to repair products, thereby ensuring items are not thrown out. As with other opportunities, in the absence of e-commerce, consumers’ options are restricted to retail stores located in their local or regional area. It is not always the case that consumers have access to stores providing spare parts, especially if they are located in areas that are not urban city centres. With e-commerce, consumers can obtain these spare parts regardless of their location. It can therefore help consumers fix products, replacing damaged or worn parts, thereby allowing them to increase the life of these items. The market for spare parts most often involves machines such as small ICT products or household appliances²⁵⁶.

Considering this, it is not certain how large the online market for spare parts is and what impact it has on lowering the carbon footprint of commerce. Nevertheless, a European Commission study indicated that consumers prefer to repair products before purchasing new products and attempt to do so. In line with such preferences, the European Commission has instituted eco-design regulations requiring appliance manufacturers to make spare parts available, ensure products can be replaced, and provide information on the repair and maintenance of their products²⁵⁷. Digital Product Passports can also help foster this market as they can include details on how goods can be repaired, allowing for an extended product life cycle.

Another opportunity fostering circularity and arising out of e-commerce can be found in the sharing economy, a type of peer-to-peer activity in which goods and services are shared amongst consumers, often with the help of an online platform. Considering the environmental goals of the Green Deal, the sharing economy can help in lowering CO₂ emissions and reducing waste by replacing demand for new products with second-hand items. Furthermore, resources can be more efficiently used by sharing them with other users. E-commerce platforms that represent the former include the aforementioned Vinted, which, in addition to allowing users to sell second-hand clothing, allows them to temporarily rent them out to other users. Other examples include Peerby, which allows users to rent household items²⁵⁸. One e-commerce platform highlighting the possibility of more resource efficiency is Blablacar, which connects users seeking to carpool. This reduces the CO₂ footprint of the journeys compared to individuals driving alone to their destination²⁵⁹. As with other areas, elements of the sharing economy existed before the advent of e-commerce, but online platforms have allowed significant growth of this market²⁶⁰.

Another area in which e-commerce platforms are creating opportunities is in product take-back schemes. A take-back programme involves a manufacturer or retailer providing the possibility to consumers to return or sell-back old products, which the manufacturer or retailer can then use to re-

²⁵⁵ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁵⁶ Ibid.

²⁵⁷ Ibid.

²⁵⁸ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁵⁹ Blablacar, *What is sharing economy at blablacar*. Available at: <https://blog.blablacar.com/blog/reinventing-travel/sharing-economy>.

²⁶⁰ Ibid.

sale, refurbish, or break down to re-use materials²⁶¹. In the EU, the Packaging and Packaging Waste Directive (94/62/EC) as well as the Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU) requires manufacturers and retailers to provide take-back logistics for consumers and other businesses. Examples of take-back policies in this regard include Apple and HP's schemes which allow for second-hand product returns and buybacks for the purpose of refurbishing and re-selling, recycling or making use of components^{262,263,264}. Another example involves IKEA, which provides for take-back schemes of old furniture which can be repaired, refurbished and re-sold. They also provide services helping consumers repair furniture they have previously purchased²⁶⁵. E-commerce in this context represents an opportunity as its infrastructure (delivery services, online platforms, and warehouses) can facilitate take-back logistics for both the consumer and manufacturer.

Nevertheless, there has been criticism of online retailers creating difficulties for consumers to use take-back schemes²⁶⁶. It has been noted, for example, that packaging requirements have been set at restrictive levels. Furthermore, for some online retailers, devices are required to be brought to physical locations or require contact with customer support teams²⁶⁷. Deutsche Umwelthilfe (DUH), a German environmental and consumer protection association investigated compliance with WEEE directive requirements and found several of such issues in major online retailers including Amazon, Apple, and IKEA, as well as German companies including Karstadt, Obi and Galeria Kaufhof. It noted that in several cases, the possibility of returning products as part of take-back schemes was not sufficiently advertised or communicated and in some cases, this possibility was even refused²⁶⁸.

Finally, the treatment of returns in e-commerce logistics is an important consideration when assessing its environmental impact. As noted above, the return rate of products purchased online is significantly greater than in traditional retail. While returns can theoretically be resold, several studies have indicated that many are simply disposed of. It has been highlighted that small companies making use of larger platforms such as Zalando often use the latter's warehouses for a fee. In such cases, it can be more economical to destroy the returned product than to pay for it to continue to be stored in the warehouse²⁶⁹. Other large retailers such as Shein employ "test and repeat" business models (spearheaded by H&M and Inditex) whereby unsuccessful lines are decommissioned. Such unsuccessful items, including returns, are disposed of rather than re-sold due to the costs of doing so and the already demonstrated lack of appeal²⁷⁰.

²⁶¹ Circular Economy Practitioner Guide, *Take-back program*. Available at: <https://www.ceguide.org/Strategies-and-examples/Dispose/Take-back-program#:~:text=A%20%E2%80%9CTake%20Back%20Program%E2%80%9D%20is,logistics%20and%20material%20processing%20firms>.

²⁶² Apple. Available at: <https://www.apple.com/shop/trade-in>.

²⁶³ HP, Sustainable impact. Available at: <https://www.hp.com/us-en/hp-information/sustainable-impact/planet-product-recycling.html>.

²⁶⁴ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁶⁵ Ecommerce Europe., 2021, *Collaborative Report on Sustainability and e-commerce*. Available at: <https://ecommerce-europe.eu/wp-content/uploads/2021/06/Collaborative-Report-on-Sustainability-and-e-Commerce-June-2021-2nd-edition.pdf>.

²⁶⁶ EcoSurety, *WEEE legislation changes in Germany to address retailer take-back non-compliance*. Available at: <https://www.ecosurety.com/news/weee-legislation-changes-in-germany-to-address-retailer-take-back-non-compliance/>.

²⁶⁷ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁶⁸ EcoSurety, *WEEE legislation changes in Germany to address retailer take-back non-compliance*. Available at: <https://www.ecosurety.com/news/weee-legislation-changes-in-germany-to-address-retailer-take-back-non-compliance/>.

²⁶⁹ Joint Research Centre, 2020, *Identification and assessment of opportunities and threats for the Circular Economy arising from E-commerce*. Available at: <https://publications.jrc.ec.europa.eu/repository/handle/JRC122233>.

²⁷⁰ Dilys, W., 2022, *Shein: the unacceptable face of throwaway fast fashion*. The Observer. Available at: <https://www.theguardian.com/fashion/2022/apr/10/shein-the-unacceptable-face-of-throwaway-fast-fashion#:~:text=Shein%20ships%20to%20more%20than,put%20them%20back%20in%20circulation>.

4.2. Opportunities and threats stemming from European legislation

From a legislative perspective, there is no overarching, integrated EU policy instrument covering the sustainable production and consumption of all products nor the availability and reliability of information on these products to consumers.

In the last decades, several efforts have been made to make products and services more environmentally sustainable and transform consumption patterns. The European Green Deal²⁷¹ has provided the overall vision to tackle climate and environmental challenges with key policies and measures to ensure climate neutrality. Moreover, the Circular Economy Action Plan²⁷² has further identified key actions to be implemented to accelerate the transition towards a circular economy model.

Within this policy framework, several upcoming initiatives tackle sustainability issues from both the production side (i.e. how the product is designed and sold) and the consumption side, for example, by targeting changing consumption patterns and increasing the availability of information to consumers to enable them to make informed decisions.

At the same time, when it comes to legislation, there are still areas that could further foster sustainability and circularity in online sales. This section explores how upcoming legislative files could enhance the environmental sustainability of online sales.

4.2.1. Making products more sustainable

From the product policy side, within the policy framework of the Circular Economy Action plan and the EU Green Deal, the European Commission has recently published several initiatives tackling the design and production stage of goods. One of the most awaited initiatives is the “Eco-design for Sustainable Products Regulation”²⁷³ (ESPR) issued in March 2022. The proposal introduces a frame and method for establishing sustainability-related requirements for products through delegated acts. The objective is to introduce sustainability principles to regulate the environmental impact of goods.

One of the key novelties of the approach is the extended scope of the framework regulation. It goes beyond energy-related products and is applicable to all physical products traded on the European market, including consumer products (i.e. phones, tablets, etc.) and intermediary products (i.e. unfinished goods made from steel, cement and chemicals that require further manufacturing or transformation). Only a few products, such as food, feed, and medicinal products, are excluded from the scope.

Although existing sector-specific legislation will remain the principal tool to adopt sustainability requirements, the Eco-design for Sustainable Products Regulation (ESPR) can nonetheless intervene if the sector-specific legislation fails to address the sector’s environmental impact. Regarding online sales, the proposed regulation covers physical goods traded on the European market, except for digital

²⁷¹ European Commission, 2019, Communication on the European Green Deal, COM(2019)640 final. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF.

²⁷² European Commission, 2020, Communication a new Circular Economy Action plan for a cleaner and more competitive Europe, COM(2020)98 final, available at: https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF.

²⁷³ European Commission, 2022, Proposal for a regulation Regulation establishing a framework for setting ecodesign requirements for sustainable products, COM(2022)142. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:bb8539b7-b1b5-11ec-9d96-01aa75ed71a1.0001.02/DOC_1&format=PDF.

or cloud services. As discussed in Chapter 2, on-demand services are growing within e-commerce, they represent an important share of web traffic, and it would be important to include these services within the scope of the ESPR to further increase potential efficiency gains in the e-commerce sector.

A relevant aspect of e-commerce's environmental sustainability is the new chapter in the ESPR on the destruction of unsold consumer products (Chapter VI) – which has been highlighted in Chapter 3 of this study as one of the rising environmental concerns, especially for textile and footwear. The ESPR establishes a framework to prevent this by focusing primarily on goods returned by consumers given their right of withdrawal set by the Consumer Rights Directive (CRD)²⁷⁴. The chapter mainly consists of information disclosure and reporting obligations regarding the destruction of those goods. More specifically, art. 20 sets out transparency obligations for economic operators holding consumer products, requiring them to disclose information on the number of unsold consumer products discarded per year. Beyond the transparency and the reporting obligation, the proposal foresees the possibility of actual bans on the destruction of unsold goods if developed by delegated acts and subject to some exemptions, for example, small and medium sized enterprises (SMEs). According to several environmental organisations, the lack of clarity in some of the definitions that relate to unsold goods (for example, when a product can be defined as damaged) can create loopholes and contrasting interpretations that make the enforcement of the chapter difficult. In addition, the possibility of exempting SMEs from the bans might make the measure less effective, considering that SMEs represent a relevant share of e-commerce enterprises in Europe²⁷⁵. According to the Digital Economy and Society Index (DESI) report, in 2021, one in five SMEs made online sales, amounting to 12% of total turnover²⁷⁶.

Another novelty introduced by the proposal is the Digital Product Passport. **The fact that products carry a passport is not new. However, the use of legislation and leveraging both green and digital transformation is.** In particular, the proposal defines the Digital Product Passport as a set of data specific to a product that includes the information (to be specified in the delegated act) and is accessible via electronic means through a data carrier. While the proposal sets out the overall framework, product-specific legislation will be used to define the criteria and standards included in the product passport. In particular, technical standards will be developed to identify the key product information to increase circularity and decrease the product's environmental impact.

The objective is to ensure that different stakeholders (i.e. consumers, market surveillance, competition, customs authorities, and companies) have access to information on the product's circularity and environmental impact. For example, consumers will have access to relevant and verified information on the quality of the product. At the same time, manufacturers will be able to track its life history, enabling them to re-manufacture or repair the product and also track raw materials and production. At the same time, market surveillance and customs authorities will have access to information needed to carry out controls.

The Digital Product Passport has the potential to enable access to information that substantiates environmental claims. It will help identify and fight greenwashing and penalise companies that are not working sustainably if the process is also accompanied by standardisation efforts for an environmental

²⁷⁴ Directive 2011/83/EU on consumer rights amending Council Directive 93/13/EEC and Directive 1999/44/EC of the European Parliament and of the Council and repealing Council Directive 85/577/EEC and Directive 97/7/EC of the European Parliament and of the Council. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011L0083&from=EN>.

²⁷⁶ ECOS, 2022, Position Paper Ecodesign for sustainable products regulation, how to ensure it makes sustainable products the norm. Available at: <https://ecostandard.org/wp-content/uploads/2022/06/ECOS-ESPR-Consultation-position-paper.pdf>.

²⁷⁷ Digital Economy and Society Index (DESI), 2022, *Integration of digital technology*. Available at <https://digital-strategy.ec.europa.eu/en/policies/desi-integration-technology-enterprises>.

impact methodology. In this regard, it will be important to harmonise how the environmental footprint is calculated to provide information that can be comparable with products in the same category (see Chapter 3 on different calculation methods).

Another area of synergy between e-commerce and Eco-design regulation relates to new obligations concerning the display of labels and access to the product passport. These obligations set out in art. 25 are also valid for retailers in (online) distance selling. The ESPR specifies that labels should attract the attention of the customer browsing through the products displayed. To ensure that the label is accessible to customers when considering a purchase, both the dealer and the responsible economic operator should show it whenever advertising the product, also in cases of online selling. This specification does not, however harmonise the way of displaying such labels. As mentioned in the legislation, using a delegated act will help identify the most effective way of displaying the label. Considering that a substantial part of e-commerce now takes place on mobiles, an important aspect to consider when developing the future delegated act is how the information on the products and labels should be displayed in various formats. E-commerce could also enable more informed decisions by providing new solutions to access information. Examples range from enabling sustainability filters when scrolling products/services, using data to communicate information throughout the product's lifecycle, or access to digitalised information (online manuals).

In this regard, the use of EU-wide labels to facilitate the comparability of products by consumers would be an interesting practice to explore further. Currently, several existing EU and international ecolabels of varying quality are used in the EU²⁷⁷, and 3 out of 4 products display an environmental claim in Europe²⁷⁸. As a result, consumers might not be able to compare products and be confused when choosing between several 'green' options. To tackle these challenges, the upcoming proposal on "substantiating green claims"²⁷⁹ is expected to clarify rules on the types of green claims that can be made and require companies to prove their environmental declaration against a standardised methodology.

Concerning market surveillance, art. 29 introduces obligations for online marketplaces and online search engines to cooperate with market surveillance authorities. In particular, they must remove illegal content when required to do so by the authorities. In this regard, the new definition set out in the Digital Service Act (DSA) states illegal content as "any information or activity, including the sale of products or provision of services which is not in compliance with Union law or the law of a Member State, irrespective of the precise subject matter or nature of that law"²⁸⁰. The definition represents a new paradigm for online sales governance and digital legal compliance. For example, if European (or national) law mandates certain information duties on the sustainability of goods/services online, failure to comply with these obligations would render the good/service illegal within the scope of the DSA.

²⁷⁷ European Commission, 2019, Commission staff working document, "sustainable products in a circular economy- towards an EU product Policy framework contributing to the Circular Economy, SWD(2019)92 final. Available at: https://ec.europa.eu/environment/pdf/circular-economy/sustainable_products_circular_economy.pdf.

²⁷⁸ BEUC, 2022, *the EU Ecolabel, helping consumer and business make the right choice for the environment, factsheet*. Available at: https://www.beuc.eu/sites/default/files/2022-09/BEUC-X-2022-082_The_EU_Ecolabel_Factsheet.pdf.

²⁷⁹ European Commission Initiative on the Environmental performance of products and businesses-substantiating claims, more information are available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12511-Environmental-performance-of-products-businesses-substantiating-claims_en.

²⁸⁰ European Commission, 2020, *Proposal for a regulation on the Single Market for Digital Services (digital Services Act) and amending directive 2000/31/EC, COM(2020)825 final*. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020PC0825&from=en>.

From the internal market perspective, it is also worth mentioning **the strengthening of market surveillance of defective products with the establishment of an Administrative Cooperation Group (ADCO)** composed of national market surveillance authorities and the setting out of measures to empower the Commission to define a minimum number of checks on products. Consumer and environmental organisations have positively received reinforced cooperation and market surveillance. They are particularly important considering that around 10% of the anticipated energy savings from ecodesign rules were lost as a result of non-compliant products (20-25% of all products in terms of ecodesign requirements) that were placed on the market²⁸¹. The proposed regulation reinforces controls on the products and includes market surveillance implementing plans, targets for checks and the use of the Digital Product Passport for automatic custom controls operators.

Market Surveillance Authorities (MSAs) face several challenges regarding e-commerce, including identifying and tracking along the supply chain of non-compliant products. In this regard, e-commerce platforms could have a role to play since they enable economic operators to reach a large number of customers and intermediate the sale of products. For example, specific requirements could be established to foster cooperation with authorities, e.g. granting MSAs access to online marketplaces to identify non-compliant products sold online.

Moreover, Regulation (EU) 2019/1020 on market surveillance and compliance of products²⁸² allocates to e-commerce actors some liabilities related to product compliance and conformity. The Regulation holds them responsible, for example, when the manufacturer and importer are not established in the Union, and no 'authorised representative has a written mandate from the manufacturer designating the authorised representative to perform the tasks. Moreover, the Regulation introduces in art. 3(11) the notion of a "fulfilment service provider", namely an economic operator or any natural or legal person performing in the course of its commercial activity at least two of the following services: warehousing, packaging, addressing and dispatching without having ownership of the product involved.

With the inclusion of the new category within economic operators, owners and operators of e-commerce sites will bear some liability concerning product compliance and conformity. For example, these new actors will also be responsible for tasks such as a) maintaining EU conformity and performance declarations and presenting these documents to authorities upon request, b) informing the market surveillance authorities where reasons exist to believe a product presents a risk and c) cooperating with authorities when requested. The fulfilment service provider is a newly created category to make sure there is always one economic operator responsible for these tasks. Concerning ecodesign, the proposal mentions that online retailers will have responsibilities as operators, particularly to ensure that the information on the products exists and that the passport includes all the information required by secondary legislation.

Parallel to the effort to make products sustainable, initiatives aiming at decarbonising key ecosystems have also been set up. For example, the textile strategy, released in 2022, provides a set of actions to be implemented in the next years to make the textile sector more circular. Just to name a few, the strategy announces design requirements, the introduction of clearer information on textiles and the Digital Product Passport. The strategy also focuses on the consumer side, announcing actions to empower consumers and tackle greenwashing, stopping overproduction and overconsumption of

²⁸¹ ECOS, 2022, *Position Paper Ecodesign for sustainable products regulation, how to ensure it makes sustainable products the norm*. Available at: <https://ecostandard.org/wp-content/uploads/2022/06/ECOS-ESPR-Consulation-position-paper.pdf>.

²⁸² Regulation (EU) 2019/1020 on market surveillance and compliance of products and amending Directive 2004/42/EC and Regulations (EC) No 765/2008 and (EU) No 305/2011. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1020&from=EN>.

textiles, and discouraging the destruction of unsold or return textiles together with a harmonised EU extended producer responsibility.

Finally, the revision of the packaging and packaging waste directive (forthcoming) will likely address issues such as overpackaging and packaging waste, which will be crucial for e-commerce sustainability.

4.2.2. Empowering consumers

From the consumption side, increasing e-commerce sustainability can be done by changing consumption patterns, enabling consumers to make informed decisions, and adopting more environmentally sustainable behaviour. Important aspects in this regard include the accessibility and readability of information provided to consumers, enforcement of consumer protection and incentives for sustainable consumption.

The proposed directive “empowering consumers for the green transition”²⁸³ addresses some of the key consumer issues around the sustainability of products to enable consumers to make informed decisions. The revision amends horizontal consumer law, namely the Consumer Rights Direct (CRD)²⁸⁴ and the Unfair Commercial Practices Directive (UCPD)²⁸⁵, it prohibits traders from making certain types of environmental claims deemed to be misleading (vague environmental claims, e.g. “green”, “eco-friendly”, “good for the environment”). It bans several practices associated with greenwashing, early obsolescence and non-transparent labels.

The UCPD provides a legal basis to ensure that traders do not present environmental claims in ways that are unfair or misleading to consumers. It does not prohibit the use of green claims as long as they are not unfair. Already in 2021, with the release of the European Commission Guidance on the interpretation and application of UCPD²⁸⁶, more clarifications were provided to help authorities interpret and apply the UCPD to environmental claims. In this regard, the European Commission’s guidance defined greenwashing in the context of business to consumer commercial practices concerning the environmental attributes of products. Interesting examples were provided, which clarify the cases where an environmental claim can be misleading, for example:

- it “contains false information and is therefore untruthful”, i.e. using the term ‘biodegradable’ for a product which is not actually biodegradable or for which no tests have been carried out or exaggerating the positive environmental impact of a product or service;
- it “deceives or is likely to deceive the average consumer, even if the information is factually correct” in respect of the items referred to in art. 6(1)(a) to (g)²⁸⁷, i.e. using complex or jargon heavy language and implying that items are eco-friendly through packaging and logos when it is not the case; and

²⁸³ European Commission, 2022, Proposal for Directive amending directive amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and better information, COM(2022)143 final. Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:ccf4e0b8-b0cc-11ec-83e1-01aa75ed71a1.0012.02/DOC_1&format=PDF.

²⁸⁴ Directive 2011/83/EU on consumer rights amending Council Directive 93/13/EEC and Directive 1999/44/EC of the European Parliament and of the Council and repealing Council Directive 85/577/EEC and Directive 97/7/EC of the European Parliament and of the Council. Available at <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011L0083&from=EN>.

²⁸⁵ Directive 2005/29/EC concerning unfair business-to-consumer commercial practices in the internal market and amending Council Directive 84/450/EEC, Directives 97/7/EC, 98/27/EC and 2002/65/EC of the European Parliament and of the Council and Regulation (EC) No 2006/2004 of the European Parliament and of the Council. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32005L0029&from=EN>.

²⁸⁶ European Commission, 2021, Guidance on the interpretation and application of Directive 2005/29/EC of the European Parliament and of the Council concerning unfair business-to-consumer commercial practices in the internal market, 2021/C 526/01. Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229\(05\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229(05)&from=EN).

²⁸⁷ Namely on the existence or nature of the product, the main characteristics of the product, the extent of the traders’ commitments, the price or the manner in which the price is calculated, the need for a service, part, replacement or repair, consumer rights.

- it consists of “vague and general statements of environmental benefits without appropriate substantiation of the benefit and without indication of the relevant aspect of the product the claim refers to”. For example, using terms such as ‘conscious’ and ‘responsible’ could be misleading since, due to their vague and ambiguous nature, they may refer to numerous aspects, including social or economic conditions.

As mentioned in the previous chapters, almost all online stores sell products that make a sustainability claim. However, in several cases, it is unclear whether the claim covers the entire product, only one of its components, the company’s overall environmental performance, or only certain of its activities²⁸⁸. In this regard, the Swedish Consumer Agency has provided recommendations on how to apply the directive. For example, to avoid misleading consumers, the trader should ensure that environmental claims displayed on the product landing page concern the actual environmental impact of the specific product and are distinguished from other, broader claims regarding that trader and its practices²⁸⁹.

Next to legislation and government guidelines, court decisions are also good examples demonstrating the growing importance given to misleading environmental claims. For instance, in 2022, in Italy, the local Court of Gorizia upheld a company’s request to order its competitor to stop making “vague, false, and non-verifiable green claims” and concluded that it constituted an unfair commercial practice²⁹⁰. To reach this conclusion, the court used the UCPD guidelines published by the European Commission, which could allow its reasoning to be followed in other jurisdictions of the European Union. Similarly, in Sweden, the Swedish Patent and Market Court assessed that green claims made by a cosmetic company were vague and without clear qualifications²⁹¹. These court decisions are noteworthy because they put greenwashing beyond the scope of consumer protection investigations and sanctions imposed by national authorities, and enter into the scope of competition law, with the possibility to demonstrate the loss of market shares to competitors due to greenwashing, and therefore seek damages from such practices²⁹².

The proposal on “empowering consumers to the transition” further builds on the 2021 European Commission guidance by specifying definitions and banning additional practices. In particular, art. 1 amends the Unfair Commercial Practice Directive by adding new definitions, encompassing environmental claims, sustainability labels, certification schemes and other important concepts to clarify how the directive should be applied to sustainability aspects. The proposal also amends the list of product characteristics about which the trader should not mislead a consumer and includes the product’s environmental or social impact, durability and repairability. The definition of key sustainability and environmental concepts is an important addition to ensure homogeneous interpretation at national level and avoid loopholes in legislation. However, a point that could be improved in the current proposal is to set out the conditions that should define certification schemes and independent monitoring systems to ensure that schemes are credible and the conditions not

²⁸⁸ European Commission, 2021, Guidance on the interpretation and application of Directive 2005/29/EC of the European Parliament and of the Council concerning unfair business-to-consumer commercial practices in the internal market, 2021/C 526/01. Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229\(05\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229(05)&from=EN).

²⁸⁹ Swedish Consumer Agency, 2020, Consumer Ombudsman, Recommendations for developments of the Guidance on the implementation/application of Directive 2005/29/EC on unfair commercial practices, 29 October 2020, s. 3.1.

²⁹⁰ Piovano, C., Andolina, A., 2022, *Italy’s first greenwashing case between corporates*. Available at : <https://www.cliffordchance.com/insights/resources/blogs/business-and-human-rights-insights/2022/01/italys-first-greenwashing-case-between-corporates.html>.

²⁹¹ Swedish Patent and Market Court PMT 697-20, Midsona, judgment of 18 January 2021. Example found in the UCPD guidelines, 2021, p. 77. Available at: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229\(05\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021XC1229(05)&from=EN).

²⁹² Piovano, C., Andolina, A., 2022, *Italy’s first greenwashing case between corporates*. Available at : <https://www.cliffordchance.com/insights/resources/blogs/business-and-human-rights-insights/2022/01/italys-first-greenwashing-case-between-corporates.html>.

subject to interpretation. As highlighted in the chapter on the environmental footprint, several companies have in place certification processes that are not necessarily based on scientifically sound methodologies. Hence, it becomes important to define the minimum transparency and quality conditions that should be applied to certification schemes and independent monitoring systems in the directive. Another important point that could be further explored to ensure that certification schemes are credible is a potential pre-approval of these schemes by European authorities. This would avoid a proliferation of schemes that public authorities will not have the resources to retroactively verify²⁹³.

Concerning commercial practices to be considered misleading, two additional ones are also added in art. 6(1) of UCPD. The first one concerns making environmental claims related to future environmental performance without clear, objective and verifiable commitments and targets and an independent monitoring system. Again, several stakeholders have highlighted the importance of defining what “clear, objective and verifiable commitments and targets” means and what should be assessed when regulating engagements in relation to future environmental performance. The second practice added to the list relates to advertising benefits for consumers that are considered common practice in the relevant market (i.e highlighting that a product does not contain a chemical substance, when absence of this substance is a common practice for the particular product anyway).

Another important element is the obligation for traders providing a service that compares the sustainability of products to disclose information on the method of comparison, the products which are the object of comparison and the suppliers of those products, as well as the measures in place to keep that information up to date. In the context of e-commerce, comparison tools are proliferating: already in 2014, more than 1043 online comparison tools were mapped²⁹⁴. Online comparison tools allowing users to make more sustainable choices are also becoming popular, with examples from B2C retail platforms for sustainable and ethical goods, *reve en vert*²⁹⁵, *earthHero*²⁹⁶, women fashion wear (*our commonplace*)²⁹⁷, toys and tableware for children (*Greentoys*)²⁹⁸, to flights (*Flygreen*)²⁹⁹. However, there are rising questions related to the methodology used to compare different products, the setting of preferences and the information provided to make products comparable. In view of the growing uptake of comparison tools related to sustainability features, the new obligation in the UCPD becomes crucial to ensure that consumers are provided with explanations for the ranking and methodologies used in the comparison (art. 1.3 amending art. 7 of the UCPD).

Moreover, ten additional commercial practices are added to the annex of the UCPD, which are considered unfair (by being misleading or aggressive) and are therefore banned in all circumstances. These practices relate to the display of sustainability labels not set up by public authorities, generic environmental claims that the trader cannot demonstrate, and environmental claims about the entire product when it actually concerns only a certain aspect of the product.

Early obsolescence is also tackled within some of the banned practices, for example, omitting to inform the consumer about a feature of a product that limits durability. However, the proposal revolves around banning the omission of information on early obsolescence rather than banning the

²⁹³ ECOS, 2022, *Position Paper Ecodesign for sustainable products regulation, how to ensure it makes sustainable products the norm*. Available at: <https://ecostandard.org/wp-content/uploads/2022/06/ECOS-ESPR-Consulation-position-paper.pdf>.

²⁹⁴ European Commission, 2014, *Study on the coverage, functioning and consumer use of comparison tools and third-party verification schemes for such tools*. Available at: https://ec.europa.eu/info/sites/default/files/final-report-study-on-comparison-tools_en.pdf.

²⁹⁵ Available at: <https://reve-en-vert.com/>.

²⁹⁶ Available at: <https://earthhero.com/collections/upcycled-materials>.

²⁹⁷ Available at: <https://www.ourcommonplace.co/>.

²⁹⁸ Available at: <https://www.greentoys.com/>.

²⁹⁹ Available at: <https://flygrn.com/>.

practice itself. Annex I also includes practices on false claims about the durability and repairability of products and failures to inform consumers that the product is designed in such a way that if non-original spare parts are used, its functionality is limited.

In terms of liability of online marketplaces, each EU consumer law directive is different and regulates certain aspects. Hence it is crucial to clarify the roles and responsibilities of business within the wider context of the e-commerce value chain, in particular, which economic operator should be responsible and accountable vis-à-vis consumers. The DSA builds on the rules of the e-commerce directive and tackles some of the issues around online intermediaries. As a horizontal regulation, the DSA covers all services and all types of illegal content, including goods and services. In addition, online marketplaces are required to inform consumers who purchased a product or service -when they become aware of the illegality of such products or services- about a) the illegality, b) the identity of the trader, and c) any relevant means of redress. Moreover, the regulation also imposes new rules to trace sellers on online marketplaces. It sets up a new obligation for online marketplaces to randomly check against existing databases whether products or services on their sites are compliant. In terms of transparency, it also includes better information on terms and conditions, as well as transparency on the algorithms used for recommending content or products to users, and a ban on using so-called 'dark patterns' on the interface of online platforms, i.e. misleading tricks that manipulate users into choices they do not intend to make.

When it comes to enabling the repairability of products, the proposed directive makes important steps forward by improving pre-contractual information for consumers. The proposed directive amends the Consumer Rights Directive (CRD) by introducing information on the durability and repairability of goods to be provided when concluding distance and off-premises contracts. For example, consumers must be provided with information at the point of sale about a commercial guarantee of product durability and relevant information for repair (including a repairability score, whenever available). As highlighted in the previous chapter, consumers often lack reliable information on a product's environmental sustainability at the point of sale. Knowing before the purchase how long a product or software is expected to last and whether spare parts are available will allow consumers to make more informed choices.

On the commercial guarantee of durability, the trader will be obliged to inform consumers if products are covered by a voluntary producer's commercial guarantee of durability of more than two years. For software updates, the trader will be obliged to clarify for how long software updates will be provided, but only if the producer or provider made that information available to the trader. The producer, not the trader, will be accountable for repairing the product, however, the trader will be in charge of informing the consumer about the commercial guarantee of durability.

Lastly, the revision introduces the concept of a repairability score (art. 2-point 12d), which is now defined as a "score expressing the capacity of a good to be repaired, based on a method established in accordance with Union Law". According to the amended text, consumers would have to be provided with a repairability score or information about the availability of spare parts and user and repair manuals in line with the applicable law. Since the article does not provide details on the criteria and methodologies to be applied, it will be important to clarify the scope and how the scoring system will be developed. Currently, there are several initiatives to measure repairability at national level. For example, the French repair index, introduced in 2021, is the first country-level repair index on five electrical and electronical devices categories. According to BEUC, the French repair index prompted change from the manufacturers' side, who have started publishing repair guides, or

announced to facilitate access to spare parts or speed up their delivery time³⁰⁰. While other countries like Belgium and Spain have announced the introduction of national scoring systems, harmonised scoring at the European level would make it easier for consumers to make goods comparable and facilitate cross-border e-commerce trade in the internal market.

Additionally, to help consumers make purchasing decisions, the directive also provides a number of new information requirements. If the reparability score is unavailable, consumers would still have the right to information about the availability of spare parts, the procedure for ordering them and a user repair manual. Considering parallel efforts on the Digital Product Passport, the information requirements on durability and reparability could be included in the Digital Product Passport to make use of synergies between these initiatives.

4.2.3. Enabling the right to repair

Alongside these advancements, important interactions between different legislations and initiatives will also need to be explored with the forthcoming initiative on the right to repair³⁰¹.

The right to repair has been announced in several EU strategic documents, such as the European green deal, the new Circular Economy Action Plan and the new consumer agenda. The European Parliament has long been supporting consumers' right to repair and better reparability, and it has called for additional measures in two resolutions³⁰². The measures mentioned encompassed mandatory labelling on the estimated lifetime and reparability of products, giving the repair industry free access to repair, and encouraging the standardisation of spare parts. According to the European Commission's call for evidence for an impact assessment³⁰³, the right to repair initiative is expected to be released in 2022. It will aim at complementing the efforts described in the previous section (ESPR and the amended UCPD and CRD), with the revision of the Sale of Goods Directive³⁰⁴ and a new right to repair.

The right to repair could entail measures to enable consumers to self-repair their products or choose a third-party service provider instead of going through the manufacturer. As mentioned by several stakeholders, e-commerce could foster repair over replacement by supporting the creation of independent repair networks. The availability of independent repairers has become important, considering the increasing relevance of cross-border e-commerce. For example, if there is no established independent repair network near the consumer, the product that needs to be repaired will have to be sent back to the manufacturer. This would mean an increase in reverse logistic but also a disincentive for the customer to use repair as primary remedy.

Currently, under the Sale of Goods Directive, consumers have the right, under different conditions, to have a product repaired by the Original Equipment Manufacturers (OEMs) or the seller. For example, these rights translate into a legal guarantee that allows consumers to have a new functional product

³⁰⁰ BEUC, 2022, *A repair score that works for consumers, recommendation for an effective tool for consumers to make more sustainable choices*. Available at: https://www.beuc.eu/sites/default/files/publications/beuc-x-2022-054_beuc_paper_on_repair_score.pdf.

³⁰¹ European Commission, 2022, *Initiative on Sustainable consumption of goods-promoting repair and reuse*, more information available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13150-Sustainable-consumption-of-goods-promoting-repair-and-reuse_en.

³⁰² European Parliament, 2020, *Resolution towards a more sustainable single market for business and consumers*, 2020/2021 (INI). Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2020-0318_EN.html.
European Parliament, 2021, *Resolution on the new circular economy action plan*, 2020/2077 (INI) Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.html.

³⁰³ European Commission, 2022, *call for evidence for an impact assessment*. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13150-Sustainable-consumption-of-goods-promoting-repair-and-reuse_en.

³⁰⁴ Directive (EU), 2019/771 on certain aspects concerning contracts for the sale of goods, amending Regulation (EU) 2017/2394 and Directive 2009/22/EC, and repealing Directive 1999/44/EC. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0771>.

at zero cost while the product is under guarantee. In the case of breakdowns outside of the legal guarantee, consumer rights vary depending on the products and the country. There is no harmonisation of rights to professional repair after the legal guarantee has expired nor direct producer liability for non-conformity of products. The lack of harmonisation on legal guarantee periods across EU member states may be an obstacle to e-commerce business models around repair. Considering the cross-border dimension of e-commerce, different national regimes relating to repairs would also imply that any measures to enable repairs would have different effects from one country to another, depending on the existing national legislation.

According to the literature, barriers to repair persist in the internal market. Consumers often have limited information on sustainability criteria and have low understanding of the product itself, for example, how the product works and the scope of its legal and commercial guarantee. A recent study by ADEME³⁰⁵ mentioned that lack of information and visibility of actors close to home was cited by 1 out of 4 interviewees as a barrier to repair. Therefore, easy access to information about repair network and accessibility might likely increase the number of repairs done, because often the consumers are unaware of the possibilities and quality of repair actors around them³⁰⁶. Moreover, economic incentives to do so remain limited even when the consumer is informed or self-informs on the repair options. In several cases, it is cheaper to buy a new product than to repair a failing one: according to Eurobarometer, 77% of European citizens would be willing to have their goods repaired. However, the price of repair represents a major obstacle³⁰⁷. Consumer preference for new products and products with strong temporal identity also represents an obstacle. This is particularly valid for electronics (mobile phones, tablets and computers), which are more likely to be replaced, even when the repair makes financial sense or when there the good is still functioning. For example, a survey conducted in Austria highlighted that almost 70% of smartphones in functioning conditions are replaced³⁰⁸. Furthermore, demographic factors, such as age, gender, income, geographic location, and education, can play a role. For example, younger users purchase cheaper products and use them for a shorter period of time than elderly consumers³⁰⁹. Early technology adopters are also more sensitive to trends than conservative consumers and are more likely to replace their devices when new versions enter the market.

On the repair side, manufacturers or OEMs play a key role in product design (modular, removable, and repairable products), manufacturing, supply and sale of spare parts, providing commercial guarantee and lastly, ensuring after-sales service (internalised or outsourced). On the other hand, sellers are generally the first point of contact for the consumer, although they do not always manage the after-sales service. Professional repairers have been increasingly relevant in the internal market and encompass different actors, such as authorised independent repairs, non-approved independent repairs, and other professional profiles. Despite the growing market for repair, barriers mostly relate to the design of products, including the guarantee period that might disincentivise the producer to repair, the lack of spare parts, and the lack of financial incentives for OEMs to give access to spare parts, since in most of the cases the profitability lies in the selling of new

³⁰⁵ Ademe, harris interactive, 2020, *les Français et la réparation : Perceptions et pratiques* – Edition 2019. Available at : <https://harris-interactive.fr/wp-content/uploads/sites/6/2020/06/rapport-francais-reparation-perception-pratique-2020.pdf>.

³⁰⁶ Ibid.

³⁰⁷ Eurobarometer, 2014, *Attitudes of European citizens towards waste management and resource efficiency*. Available at : https://data.europa.eu/data/datasets/s1102_388?locale=en.

³⁰⁸ Wieser, H., Troger, N., 2018, *Exploring the inner loops of the circular economy: replacement, repair, and reuse of mobile phones in Austria*. J. Clean. Prod. 172, 3042e3055, Available at : <https://doi.org/10.1016/j.jclepro.2017.11.106>.

³⁰⁹ Hennies, L., Stamminger, R., 2016, *An empirical survey on the obsolescence of appliances in German households*. In Resources, Conservation and Recycling 112, pp. 73–82.

products. Moreover, since repair is frequently part of the business model, there is no real incentive from the OEMs to provide parts and information to third parties to perform repair. Additionally, the multi-layered legislation revolving around repair makes it very complex for participants involved in the reuse and repair process to ensure compliance with various legislation. To name a few, rules protecting patents, trademarks and copyright laws could make repair in some cases not possible, since repair amounting to “construction” or “modification” of a patented article may consist in a direct infringement of EU law³¹⁰. Taxation on refurbished parts may render refurbishment less competitive to new spares manufactured in low-cost countries³¹¹. While to comply with Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)³¹², manufacturers and importers of refurbished spares are obliged to collect and register information on the chemical substances in the product. The use of restricted substances in refurbished spare parts can put limitations on sales and lead to inventory tracking and management challenges over time to comply with the requirements - putting administrative burdens on secondary market actors. Last but not least, waste and product safety legislation³¹³ also create obligation on refurbishment.

To address some of the challenges mentioned above, the European Commission plans to consider several options as part of the right to repair initiative, with measures including a) extending the legal guarantee both in scope and duration; b) obliging producers or sellers to repair goods beyond the legal guarantee period; c) making repair the preferred remedy or even limiting consumers' choice to have a faulty product replaced; and d) enabling the seller to replace defective products with refurbished goods and not new ones. Moreover, the ongoing negotiations on the new General Product Safety Regulation³¹⁴ will also tackle the responsibilities of online marketplaces and introduce a specific system of traceability along the supply chain, which can help improve the safety of products.

Concerning some of the questions on third-party liability of companies putting repaired or refurbished products in the market, the upcoming initiative “adapting liability rules to the digital age and artificial intelligence” will aim at revising the framework to take into account the developments towards the circular economy and digital economy on liability for damage caused by new and refurbished products³¹⁵.

From the e-commerce point of view, all these aspects are particularly relevant in view of enabling repair as business model and providing incentives to consumers to use products for longer by repairing defective goods and by purchasing more second-hand and refurbished goods. Considering the cross-border dimension of e-commerce, measures to support the emergence of independent repair networks could also limit reverse logistics and returns and encourage the use of repair services located in the consumer’s country. Important questions on maintaining high-level quality of repairs and ensuring consumer protection remain to be addressed in the upcoming

³¹⁰ Svensson, S., et al., 2021, Barriers, enables and market governance: A review of the policy landscape for repair of consumer electronics in the EU and the US, Journal of Cleaner Production 288, Available at: <https://doi.org/10.1016/j.jclepro.2020.125488>.

³¹¹ Ibid.

³¹² Regulation (EC) 1907/2006 Concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R1907>.

³¹³ Directive 2008/98/EC on waste and repealing certain directives Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02008L0098-20180705>.

³¹⁴ European Commission, 2021, Proposal for a regulation on general product safety, 2021/0170 (COD). Available at: https://eur-lex.europa.eu/resource.html?uri=cellar:e6adc4a2-da3d-11eb-895a-01aa75ed71a1.0001.02/DOC_1&format=PDF.

³¹⁵ European Commission, 2021, *Initiative on civil liability-adapting liability rules to the digital and artificial intelligence*. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12979-Civil-liability-adapting-liability-rules-to-the-digital-age-and-artificial-intelligence_en.

legislation, particularly the possible ways of using standards for repair services to strike the right balance when opening access to repair and ensuring high-level quality of repair.

4. CONCLUSIONS AND RECOMMENDATIONS

KEY FINDINGS

With the growth of e-commerce in the EU, both in absolute terms and relative to traditional retail, it becomes ever-more important to ensure that e-commerce is compatible with EU sustainability objectives and that a high level of consumer protection is maintained in Europe.

Online sales and marketplaces pose specific issues for consumer protection around information provision and personalisation practices. In addition to the specific characteristic of e-commerce, reliable information about environmental footprint is lacking.

There is evidence that e-commerce's environmental footprint currently presents hotspots, such as logistics (same-day last mile delivery, failed deliveries and product returns), over-packaging, and destruction after return. At the same time, e-commerce has the potential to facilitate more sustainable production processes and consumption patterns and ensure more circularity. Businesses have the possibility to explore the best mix of solutions to deliver accessible, affordable and sustainable models.

The combination of consumer protection issues, the impact of e-commerce on sustainability and the lack of reliable information has made it difficult for consumers to make informed decisions about the sustainability impact of their purchases online.

This study has identified four layers where European intervention could help address the challenges identified. While actions on some layers can happen in parallel (and some are already happening), the layers also build on one another, representing increasing levels of complexity for EU intervention. More specifically, this study puts forward the following recommendations:

- **Ensuring that existing legislation is complied with in the digital space:** this would entail supporting national authorities in enforcing existing legislation, monitoring online practices with digital tools and providing support to businesses to comply with existing rules;
- **Improving information provision and transparency of offers to consumers to enable them to make better decisions:** in particular, harnessing digital innovation to make it easier for the consumer to access information on the sustainability of their purchase while ensuring consumer protection;
- **Incentivising consumers and businesses to be more sustainable:** including supporting e-commerce's role in fostering repair and reuse over replacement and fostering the emergence of independent repairer's network; and
- **Ensuring information on sustainability impacts is reliable:** this would entail harmonising the methodologies for assessing the environmental footprint of e-commerce and making sure that they are communicated to consumers in a transparent and easy way.

The total turnover from e-commerce and its share in retail sales have increased sharply in recent years. This evolution has accelerated even further with the covid-19 pandemic which effectively shifted a large section of EU retail from physical stores online. In addition to the absolute growth of e-commerce, its relative importance, in comparison to purchases from traditional brick-and-mortar stores, is also steadily growing throughout Europe.

E-commerce covers a wide range of business activities, and it encompasses different business models. Each e-merchant has its own target market or markets, and its own business practices some of which give rise to specific consumer protection considerations including as regards the type of information that is provided to consumers, how this information is provided and the personalisation of offers to consumers in the digital space.

Furthermore, and related to these points, the impact of the different e-commerce business models on sustainability can vary greatly from one e-merchant to another, as do opportunities to improve sustainability performance and it is key that consumers are provided with the tools to understand the environmental impact of their online purchase decisions.

In addition to the specific characteristics of e-commerce, there is **no standardised approach that is systematically applied to fully capture the total environmental footprint** of e-commerce. Moreover, transparent communication on the environmental footprint of e-commerce and information around the methodologies used seem to be lacking.

There is evidence that e-commerce has specific impacts on sustainability which can be positive or negative. In particular, e-commerce's environmental footprint is characterised by specific challenges around logistics (same-day last mile delivery, failed deliveries and product returns), overpackaging and destruction after return. At the same time, e-commerce has the potential to facilitate more sustainable production process and consumption patterns and ensure greater circularity and there are opportunities for e-commerce legislation to further foster sustainability and circularity regarding online sales.

The combination of consumer protection issues, the impact of e-commerce on sustainability and the lack of reliable information have made it difficult for consumers to make informed decisions about the sustainability impact of their purchases online.

This study has identified five layers where European intervention could help address these challenges. While actions on some layers can happen in parallel (and some are already happening), the layers also build on one another and they represent increasing levels of complexity for EU intervention.

In particular, this study puts forward the following recommendations:

- Ensure that existing legislation is complied with in the digital space;
- Improve information provision and transparency of offers to consumers to enable them to make better decisions;
- Incentivise consumers and businesses to be more sustainable, and
- Ensure information on sustainability impacts is reliable.

5.1. Ensure that existing legislation is complied with in the digital space

There have been several recent efforts to ensure that consumers are protected online. In particular, the **Digital Service Act (DSA) provides a new narrative** on the governance of online sales. For example, under the DSA, where European (or national) law mandates disclosure and other information duties regarding the sustainability of goods/services, failure to comply with these requirements may render the transaction illegal within the scope of the DSA.

To support Member State authorities in fully enforcing the legislation, the active role of the Consumer Protection Cooperation (CPC) is crucial. The CPC network offers possibilities for EU-wide enforcement through mutual assistance between national authorities or coordinated investigation or

enforcement at EU level. It thus supports national enforcement efforts and puts enforcement authorities in a stronger position in cross-border or systematic infringements across the Internal Market. In 2021, an EU-wide sweep was conducted for the first time to identify breaches of EU consumer law related to online green claims. In order to build on the findings of the exercise:

- It would be important to keep monitoring online markets and to communicate transparently on the results of sweeps exercises; and
- Reporting on noncompliance penalties or checks in case of repeated violation could communicate the brand name of the non-compliant trader. The resulting reputational damage could raise awareness within industry, keep consumers more informed about non-compliant products and help them enforce their rights.

The growing importance of online marketplaces has fostered cross-border online shopping in the EU. This trend poses challenges for market surveillance, in particular identifying, tracking and removing non-compliant products, due to the lack of resources and the limited digital tools at the disposal of competent authorities.

E-commerce platforms could have a role to play since they enable economic operators to reach a large number of customers and intermediate the sale of products. In this regard, **the proposed regulation on ESPR** introduces new obligations for online marketplaces and online search engines to cooperate with market surveillance authorities. It also proposes controls on the products, market surveillance implementing plans, targets on checks, and the use of Digital Product Passports for automatic custom controls operators (art. 29 of the ESPR).

- The proposal could specify additional requirements to foster cooperation between authorities and e-commerce operators. For example, MSAs could be granted access to online marketplaces to identify non-compliant products sold online.

Additionally, to date, market surveillance has focused on the phase after products are placed on the market. This may put additional burdens on MSAs with limited resources and result in less effective prevention.

- Requiring online marketplaces to provide information on the products they sell and conducting identity checks of traders before they are allowed to sell on the marketplace could strengthen consumer protection; and
- When it comes to Ecodesign for Sustainable Products (ESPR), introducing pre-approved certification schemes could prevent a proliferation of schemes that public authorities do not have the resources to verify retroactively.

Another key obstacle mentioned by several stakeholders is the lack of resources and expertise of online retailers in understanding the obligations created by new legislative acts and complying with them. In addition, depending on the type of legislation and the country where they operate, online retailers might have different obligations (i.e. legal guarantee periods, green claims, etc.) within the internal market. To support online retailers in complying with their obligations:

- The **European Commission could make available a comprehensive map of obligations in all Member State jurisdictions** (such as legislation in place, relevant case law, guidelines issued by authorities, obligations and liabilities for e-commerce actors). E-commerce actors could directly contribute to this, e.g., through consultation events, pointing out compliance barriers and the kinds of support they would need.

Regarding digital tools, different market surveillance and monitoring tools (web crawlers or web scraping) are being used by some national authorities. These tools can contribute to the

automation of web product searches, providing market surveillance authorities significant time savings.

Moreover, the Digital Product Passport (DPP) will allow market surveillance and customs authorities to access traceability information needed to carry out controls. In combination with new technologies, the DPP provides an opportunity for MSAs to respond more effectively to the rise of e-commerce and improve surveillance processes. However, deploying such tools and effective monitoring requires resources, not only staff but also skills to identify non-compliant products or unfair commercial practices.

- To address these challenges, market surveillance pilot projects across the EU could be set up to explore and test some of the most promising technologies by setting up pilot projects across the EU.

5.2. Improve information provision and transparency of offers to consumers to enable them to make better decisions

The study has highlighted the importance of enabling consumers to make informed decisions and adopt more environmentally sustainable behaviour. Important aspects include the accessibility and readability of information provided to consumers and incentives to engage in more sustainable consumption.

With regards to accessibility and readability of information, the emergence of new business models and actors can be beneficial for consumer awareness. For example, the online customer journey can give the consumer quicker access to information about sustainability and could nudge consumers towards paying more attention to the potential sustainability of the products they purchase.

Nudges are design features of websites and apps that make it more likely for a consumer to take certain decisions. The right kind of nudges could encourage sustainable online shopping. For example, an easy and clear list of sustainability options in the delivery of a product could better inform consumers about the impact of their choices. Nudges could prompt win-win situations where e-commerce actors could support potential customers in better understanding the sustainability of a product or service.

- Further research should be conducted to identify ways to mitigate possible harms and ensure aggregate benefits for consumers from green digital nudges.

Additionally, e-commerce can enable new solutions to access information in a user-friendly manner. Examples range from providing sustainability filters when scrolling through products or services, layering options when providing information to consumers, and using data to communicate information throughout the product's lifecycle or when accessing digitalised information (e.g. online manuals).

Better harnessing digital innovation and tools to make it easier for the consumer to access information on sustainability properties is one of the main opportunities stemming from e-commerce. In this regard, the Digital Product Passport has the potential to enable access to information and to help substantiate environmental claims.

- To make these tools as effective as possible, it is important to harmonise how the environmental footprint is calculated to provide comparable and understandable environmental information on products and their delivery during purchasing process.

Another important tool to improve consumer awareness is the introduction of a repairability score in the revision of the CRD. According to the proposal, consumers would have to be provided with a repairability score or information about the availability of spare parts and user and repair manuals in line with applicable law. Since the article does not provide details on the criteria and methodologies to be applied, it will be important to clarify the scope and how the scoring system will be developed.

Additionally, the proposed revision of the CRD also provides a number of new information requirements. Where a repairability score is unavailable, consumers would still have the right to information about the availability of spare parts and the procedure for ordering them and information on the availability of a user repair manual.

- To maximise the sustainability impact of the Digital Product Passport, information requirements on durability and repairability could be included in the DPP;
- The DPP could carry harmonised environmental footprints based on PEF, which could be implemented machine-readably into the online shopping process. This way, the product producer could provide relevant information to retailers downstream. This could inform the consumer about the environmental footprint of the products during the online shopping process while covering the entire life cycle and more environmental impacts beyond climate change;
- **At the corporate level, e-commerce could benefit from implementing more prescriptive rules based on LCA standards or the OEF method, which could be used** in the Corporate Sustainability Reporting to make the environmental footprinting of corporations more harmonised. For example, the OEFSR for retail already addresses specificities for e-commerce. It highlights the need to correctly capture product takebacks, as this is typically higher for e-commerce than for physical retail; and
- Finally, transparent documentation of assumptions and the scope of the assessment must be ensured when incorporating the OEF methodology.

Different e-commerce business models can increase consumer empowerment. In a well-functioning market with effective competition, consumers experience better communication channels with the provider and products and services that are better tailored to their needs and demands. However, there are questions related to the methodologies used to compare different products, the setting of preferences and the information provided to make products comparable.

In view of the growing uptake of comparison tools related to sustainability features, the new obligation on comparison tools (art.1.3 amending art. 7 of the UCPD) set by the Directive on Empowering Consumers Towards a Green Transition becomes crucial to ensure that consumers are provided with information on the ranking and the methodologies used for the comparison.

The architecture of digital marketplaces, which is data driven, dynamically adjustable and personalisable, is an important factor to take into consideration when empowering consumers. In particular, digital environments can be designed to change behaviour by anticipating cognitive and affective biases in their design. For example, different versions of the digital environment can be run simultaneously to test the effect of different design choices in real time.

While the UCPD has focused on the information component of commercial practices, the provision, omission and presentation of information is only one side of the coin. Other aspects, such as choice architecture, personalised pricing and offers, are also important and should be tackled when ensuring consumer protection and enabling them to make informed decisions.

- The EU consumer acquis should adopt a more user-centric approach to ensure a high level of consumer protection. In other words, it may not be sufficient for legislators to focus solely on information provision requirements but also to explore ways in which the law can address misleading and problematic presentation of the information.

While the UCPD is flexible enough to successfully keep pace with the rapidly changing digital environments, Annex I currently focuses more on offline practices. The planned fitness check of the digital fairness of EU consumer law³¹⁶ will represent an important opportunity to shed light on challenges for consumer protection in the digital environment and whether additional action is needed to ensure an equal level of fairness online and offline.

Another important aspect to consider is consumer digital literacy and new types of consumer vulnerabilities. In digital marketplaces, most -if not all - consumers are potentially vulnerable to unfair practices. Therefore is important to move away from the “traditional” definition of a vulnerable consumer. Algorithmic proofing, automated decision making, and predictive analytics are some of the main tools used by online traders to optimise commercial performance. While these techniques can enhance the consumer experience and help them find the right product or service, they can also create new power imbalances and forms of unfair market practices.

- It would be important to enlarge the definition of vulnerable consumers in the UCPD to better cover new digital vulnerabilities.

At national level, several initiatives aim at improving consumers’ digital literacy. However, it would be important to tailor initiatives to groups outside the “traditional” vulnerable segment, such as the elderly, to all segments of the population.

- The European Commission could support national and local organisations in providing tailored training to raise consumers’ awareness online by developing and translating training materials and making guidelines available to consumer organisations and other actors.

Moreover, when it comes to greenwashing, the upcoming legislation on substantiating green claims will be crucial in ensuring that claims are reliable, comparable, and verifiable across the EU. In this context, it will be important to link it to the UCPD and CRD and ensure that a minimum safety net is provided for consumers without leaving uncovered areas.

5.3. Incentivise consumers and businesses to be more sustainable

The trend toward sustainable consumption intensified during the COVID-19 pandemic and is here to stay. Consumers have been looking for more green options (including second-hand products) and they pay greater attention to product value chains. In line with this, more consumers are trying to buy locally and support local producers.

However, these developments are not necessarily linked to a willingness to pay more for more sustainable products and services. Given that price is the main barrier for consumers when deciding whether to repair or replace, making products environmentally sustainable by design (for example, easy and affordable to repair, long-lasting etc..) is one way of addressing the barrier. The ESPR proposal introduces a frame and method for establishing sustainability-related requirements for products through delegated acts.

³¹⁶ European Commission, 2022, Initiative on digital fairness fitness of check on EU consumer law. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13413-Digital-fairness-fitness-check-on-EU-consumer-law_en

When it comes to e-commerce, **online platforms can significantly contribute to the circular economy by enabling the exchange of pre-owned, repaired or refurbished goods**, thus prolonging the life of products. Despite the growing market for repair, barriers mostly relate to the design of products, including the guarantee period that might disincentivise repair, the lack of spare parts, and the lack of financial incentives for OEMs to give access to spare parts, since profitability often lies in selling new products. Additionally, the multi-layered legislation around repair makes it complex for participants involved in the reuse and repair process to ensure compliance.

At national level, several initiatives aim to make repair more affordable and accessible to consumers, for example, by providing a repair bonus enabling consumers to claim back a share of the repair cost or reduced VAT on repairs for specific goods. Companies have also started setting up vouchers to encourage consumers to trade items via their platforms. To incentivise business models around repair, some countries have been proposing tax reductions on labour costs for repairs or VAT exemptions for spare parts.

In order to take stock of the several initiatives targeting consumers and businesses:

- The European Commission could develop a compendium of existing measures in a central repository to support Member States that wish to implement measures incentivising consumers and businesses to repair goods and extend product life spans; and
- Considering the cross-border dimension of e-commerce, measures to support the emergence of independent repair networks could also limit reverse logistics and returns and encourage the use of repair services located in the consumer's country.

The right to repair initiative is expected to be released in 2022. It will aim at complementing the efforts described in the previous section (ESPR and the amended UCPD and CRD) with the revision of the Sale of Goods Directive and a new right to repair. Important questions on maintaining high-level quality of repairs (including through potential standards) and ensuring consumer protection should be addressed in upcoming legislation.

5.4. Ensure information on sustainability impacts is reliable

To safeguard consumers from being misled when it comes to environmental claims, the upcoming legislation on “empowering consumers for the green transition” will amend the Unfair Commercial Practices Directive (UCPD) and the Consumer Rights Directive (CRD). The European Commission proposal prohibits traders from making certain types of environmental claims deemed to be misleading (vague environmental claims, e.g. “green”, “eco-friendly”, “good for the environment”) and bans several practices associated with greenwashing, early obsolescence and non-transparent labels.

This study has highlighted the increasing proliferation in online commerce of sustainability certification schemes, albeit with methodologies that vary in scientific soundness. To avoid loopholes in legislation and to ensure consistent levels of consumer protection across the Member States, it will be important to improve the framework by:

- clarifying the conditions defining the certification schemes, as well as the minimum transparency requirements of the independent monitoring systems (art. 1.1(s) amending art. 2 of the UCPD); and
- defining what “clear, objective and verifiable commitments and targets” means and what should be assessed when regulating engagement of future environmental performance (art. 1.2 b amending art. 6 para 2 of the UCPD).

The EC proposed amendments to the UCPD provide further clarification applicable to all Member States on what constitutes greenwashing. At national level, market surveillance authorities and courts have been active in assessing green claims by broadening the interpretation of the UCPD and linking their decisions not only to consumer protection legislation but also to competition law. As highlighted in this study, in some Member States, court decisions have also pointed out the loss of market share to competitors due to greenwashing and therefore sought damages from such practices.

However, enforcement and interpretation of what constitutes green-washing differs greatly across the EU. As a result, online platforms could be prompted to adopt different standards or face obstacles in penetrating different EU markets since the same claim or sustainability label could be considered misleading in one country but accepted in another. It will be important to ensure the same level of consumer protection across the single market and avoid fragmentation due to a proliferation of practices among online traders and differences in national rules.

Regarding methodological footprinting approaches, this study has highlighted the importance of harmonising the methodologies for assessing the environmental footprint of e-commerce to create a level playing field and make environmental information more comparable. Our analysis showed that standardised methodologies such as LCA and corporate footprinting are currently more scientifically sound.

- Harmonising approaches and strengthening the coverage of the entire life cycle and environmental indicators beyond climate change will enhance scientific soundness and avoid burden shifting across impact categories (e.g. lowering the carbon footprint while increasing water consumption).

When applying these methodologies in practice, it is crucial to make the assessments more specific to the e-commerce context.

- For instance, if a product is retailed online, the assessment should account for specific aspects of e-commerce, such as higher rates of returns, instead of using averages across off and online retail; and
- Underlying data should be transparent and publicly available, and additional environmental indicators beyond climate change should be mandatory to be communicated to the consumer.

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ANNEX 1 – METHODOLOGY TO EVALUATE THE SCIENTIFIC SOUNDNESS OF ENVIRONMENTAL ASSESSMENT APPROACHES AND THEIR PRACTICAL APPLICATIONS

The scientific soundness is evaluated based on six different criteria (Table 5). Those criteria were found to be vital for ensuring scientific soundness. The evaluation is only to be understood in relation to the aim of soundly quantifying the overall environmental footprint arising from e-commerce. It is an attempt to semi-quantitatively evaluate and compare qualitative criteria of relevance and by no means portrays absolutes. More criteria could be applied, but ensuring a semi-quantitatively evaluation was seen as the main goal.

Table 5: Criteria for the evaluation of scientific soundness

No.	Criterion	Explanation
1	Based on internationally recognised methodologies or standards or established by public authorities.	Approaches based on accepted international methodologies and/or standards are more reliable compared to e.g. in-house developed approaches.
2	Third-party verified.	A third party verification is an important step to ensure that the information provided is reliable, credible and correct.
3	Based on life cycle thinking and covering the full life cycle.	To ensure that no (un)intentional burden shifting across life cycle stages occurs, it is important to evaluate if the approach is based on a full life cycle.
4	Covers a wide range of environmental indicators, beyond climate change (CO ₂ -equivalents).	Environmental impact is not only about climate change and CO ₂ emissions. While this is a very relevant indicator, also other dimensions need to be considered, in order to avoid burden shifting across impact categories (e.g. improving in issues related to climate change, while worsening on water use). A comprehensive environmental assessment relies on the coverage of a wide range of environmental indicators.
5	Addresses relevant aspects for e-commerce (e.g. packaging, logistics, returns).	Approaches that do not cover those aspects that are identified as relevant in the scientific literature may provide incomplete information and may not point to the right actions.
6	Transparent and underlying data are easily accessible.	Transparency and traceability of data used is a key driver to trust the information provided.

Source: PRé Sustainability.

The methodology follows the following three steps:

Step1: First, assess whether the approach meets the criteria in Table 5. For each criterion, a score of 0, 1 or 2 is assigned, where 0 means 'not met', 1 means 'partially met', and 2 means 'fully met'.

In cases where sub-categories of approaches are found to be too broad for evaluation, such as in the standardised approaches, most commonly used frameworks are assessed separately and the scores are subsequently averaged. The individual assessment of criteria per approach results in total scores per approach, where:

- 0 points - 4 points (red) is interpreted as insufficient scientifically sound.
- 5 points - 8 points (orange) is interpreted as partially scientifically sound.
- 9 points - 12 points (green) is interpreted as sufficient scientifically sound.

Step 2: Second, we evaluate **practical applications** by relevant e-commerce merchants of the approaches, based on conformity with the relating approach. The example cases are taken from publicly accessible information, for relevant companies in the identified sectors. The evaluated information serves as case studies and is by no means exhaustive. For neutrality, no company names are mentioned in the main text. Table 6 provides an overview of examples and sources.

Table 6: Practical examples of implementation with company names and sources

Example Nr.	Approach	Company (sector)	Sources
1	Standardized: LCA	Apple (Electronics)	38
2	Standardized: LCA	Backmarket (Electronics) & Marktplaats (multiple sectors)	39-42
3	Standardized: Corporate Footprint	Amazon (multiple sectors)	52-54
4	Standardized: Corporate Footprint	UPS (Delivery service)	13,51
5	Issue-spec.: Certifications	Amazon (multiple sectors)	60-63
6	Issue-spec.: Indices	H&M Higg Index (Fashion & Accessories)	65-70
7	Issue-spec.: Indices	Carrefour Eco-score (Groceries)	71-73

Source: PRé Sustainability.

The practical application is evaluated per criterion in relation to the requirements of the approach followed. For each criterion, a score of 0 or 1 is assigned, where:

- 0 points means not complying with theory of relevant approach.
- 1 points means complying with theory of relevant approach.

The individual assessments of criteria result in total conformity scores per practical application:

Total sum of scores per approach:

- 0 points – 3 points (red) is interpreted as not complying with relevant approach.
- 4 points - 6 points (green) is interpreted as complying with relevant approach.

Step 3: Lastly, we multiply both previous scores to achieve a **meaningful weighted score** of the practical applications on basis of (1) the scientific soundness of the approach and (2) the conformity of the application to the approach.

Total weighted scores are interpreted as follows:

- 0 - 24 (red) - insufficient scientifically sound.
- 25 – 48 (orange) - partial scientifically sound.
- 49 - 72 (green) - sufficient scientifically sound.

Disclaimer

The scores have been assigned based on expert knowledge in the field of environmental footprinting. The practical examples have been chosen as representations for the sector, acknowledging that there is a broad variety of applications. We have however tried to ensure a good representation of important sectors for e-commerce, industries, and relevant players to represent this variety. The practical application is evaluated on the basis of what is currently publicly available and accessible. The evaluation of scientific soundness is an attempt to semi-quantitatively assess qualitative criteria.

The rise of online sales and marketplaces poses new challenges to product safety, consumer protection, and unfair business practices. At the same time, e-commerce has the potential to facilitate more sustainable production processes and consumption patterns and ensure more circularity. This study provides information on the role of e-commerce in implementing the European Green Deal and makes recommendations for future action.

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