Digital communication strategies for transparent footprints

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Change Log

Version	Description of change
V0.1	Initial version preparation
V0.2	Update after presenting the literature and state of practice review at a conference
V1	Include interview and survey results and finalize the first full draft
V2	Update after internal review

List of abbreviations

Abbreviation/Term	Description
CBCE	Choice-Based Conjoint Experiment
DCE	Discrete Choice Experiment
OLS	Ordinary Least Squares
RCT	Randomized Control Trial
SPE	Stated Preference Experiment
WTP	Willingness To Pay
WTU	Willingness To Use

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Executive Summary

This deliverable addresses Task 2.4 of the GreenTurn project, which aims to define effective digital communication strategies for transparently presenting the ecological footprint and social impact of e-commerce deliveries and returns. The task focuses on understanding what specific sustainability-related information should be communicated to consumers and how it can be presented in a way that is clear, credible, and motivating.

To fulfil this objective, we combined four methods. We began with a structured literature review to synthesise existing empirical research on how ecological footprint and social impact information is currently understood. In parallel, we conducted a web-scraping analysis to systematically map current communication practices among major e-commerce retailers across the EU, complemented by selected best-practice examples. We then carried out semi-structured stakeholder interviews to explore the practical challenges and opportunities firms face when communicating sustainability-related information, reflecting diverse perspectives. Finally, we conducted a large-scale consumer survey across five countries to test which message framings are most effective in motivating more sustainable delivery choices.

The literature review focused on nudging interventions aimed at steering consumers toward more sustainable delivery choices. Most studies assessed light-touch interventions (such as defaults, labels, and information prompts) and measured their effects on stated or revealed preferences. Prior research findings are promising for nudges that combined environmental messaging with convenience or social norms, though few studies examined long-term behavioural effects or implementation in real-world e-commerce contexts. The web-scraping analysis mapped practices among the largest EU-based e-tailers, revealing that most of them offer limited sustainability information at checkout, with inconsistent use of icons, labels, or explanatory text. A small number of frontrunners are experimenting with clearer or more concrete messages.

Our interviews with e-commerce firms, logistics service providers, and industry experts highlighted key challenges, including the risk of greenwashing, lack of standardisation, and limited consumer awareness, as well as opportunities for more tangible, actionable messaging. Building on these insights, the consumer survey assessed how different ways of communicating ecological footprint and social impact influence willingness to opt for greener delivery options. While consumer segments differ in how motivated they are by sustainability messaging, the relative effectiveness of different message types is consistent. Messages that translate abstract CO_2 data into everyday terms (such as saved trees or avoided kilometres) resonate more strongly than those using neutral figures or percentages. Positive emotional framing further enhanced motivation.

Across these methods, one insight consistently stood out: sustainability communication must be tangible and relatable to be effective. This finding supports the definition of digital communication strategies that help e-commerce firms transparently communicate ecological footprint and social impact in ways that resonate with consumers and motivate more sustainable delivery choices—while avoiding greenwashing. Within the GreenTurn project, the insights from this deliverable will feed into WP4 and contribute to the development of targeted recommendations for logistics service providers (T6.1) and retailers (T6.2).

1. Problem Statement

Over the past years, e-commerce companies have competed for customers by offering them fast, convenient, and usually free delivery and return options. At this point, consumers basically expect fast and convenient delivery, preferably free of charge. Yet, society starts to realise the negative externalities of such a level of service, including increased emissions and congestion due to the increased number of trips (Davydenko and Hopman, 2020; Nanda and Patnik, 2023. As a result, many scholars started to investigate consumers' willingness to select alternative, more sustainable delivery options. Prior research demonstrates that nudges, which are small adjustments in choice architecture like adding information about CO_2 saving, can shift consumer decisions toward sustainable delivery options (Belvedere et al., 2024; Deitl et al., 2024; Ignat and Chankov, 2020; Nijssen et al., 2023). Hence, it seems that offering sustainable delivery options and nudging consumers towards these is a straightforward way to curtail its emissions. However, at this point it seems that very few EU webshops offer a dedicated sustainable delivery option, let alone attempt to nudge consumers toward these options.

In this deliverable, insights from research and practice are used to infer how e-commerce companies can use nudging to encourage sustainable delivery choices. To investigate this, we conduct a review of the literature on nudging in the domain of logistics and compare this with interviews with practitioners and a review of the state of practice through web scraping. By using this approach, we intend to show an implementation gap between theory and practice. Next, we discuss best practices and give recommendations for communication strategies.

2. Approach

This deliverable employs a mixed-methods approach to explore how nudging techniques can be used to encourage more sustainable consumer behaviour in the context of e-commerce deliveries and returns. The methodology integrates insights from a review of academic literature, web scraping, interviews, and a survey to comprehensively examine both current industry practices and academic insights.

In Chapter 3, we present findings from a targeted literature review, concentrating on academic publications that specifically examine the effectiveness of nudges in encouraging sustainable delivery and return choices. The aim was to identify which types of nudges, such as information provision and monetary incentives, have proven successful in influencing consumer behaviour toward sustainable delivery or return options. This review also aims to contextualise nudging within broader behavioural science frameworks and assess its applicability to e-commerce scenarios.

Chapter 4 presents a state-of-practice analysis, which was conducted using web scraping techniques and interviews. First, the web scraping analysis targeted major e-commerce platforms to extract real-world data on delivery and return options. The focus was on identifying how and to what extent sustainability is currently communicated to consumers during the checkout processes. The scraping effort captured data points such as the availability of sustainable options, the language used to frame these options, and the visibility of sustainability-related cues. Complementing this, qualitative interviews were carried out with key stakeholders, including representatives from e-commerce companies, regulators, and logistics experts. These interviews aimed to uncover industry perspectives on the feasibility and effectiveness of implementing nudging strategies. They also provided insight into internal decision-making processes and perceived consumer responses to sustainability messaging.

Building on these insights, Chapter 5 formulates a set of best practices for applying behavioural nudges in e-commerce. These practices are grounded in behavioural theories and enriched by concrete examples from across Europe, showcasing how various platforms and initiatives have successfully implemented nudging strategies to promote sustainable consumer choices.

Finally, in Chapter 6, we present the results of a consumer survey designed to test the perceived motivational impact of various sustainability-related messages and nudges. Here we present key takeaways with regard to sustainability messaging and show how individual-specific variables may influence the preferred sustainability messaging.

3. Literature Review

In this section, we review the literature that investigates the effectiveness of nudges in the field of e-commerce deliveries.

3.1. Approach

For the systematic review, the SCOPUS database was used as the primary source, ensuring a structured and replicable search process. The search strategy was developed iteratively, starting with a set of known papers relevant to sustainability, nudging, and delivery options. These papers were used to refine search terms and expand the dataset by examining references and citations. The final search string was constructed to ensure that all relevant papers within the field were captured while ensuring they were related to 'sustainability', 'nudging', and 'delivery'.

The first SCOPUS search yielded 234 documents, which were all evaluated based on titles and, if needed, abstracts. Next, we limited the search string in the number of journals to include, where we only included those journals that published at least one paper with a fitting title/abstract (search string in Appendix A). This finally led to a set of 52 papers, of which we read all abstracts and, if needed, the introduction and methodology section. The final SCOPUS search yielded an initial set of 16 papers. To verify the completeness of the set of papers, additional tools, ConnectedPapers and ResearchRabbit, were used to map conceptual links between papers. This approach identified one additional relevant paper, confirming that the dataset effectively captured all interrelated research in this domain.

The selected 17 papers were analysed with a focus on categorising the types of nudges used to promote sustainable delivery choices. Given the particular interest in informational nudges, a classification system was developed to assess the depth of information provision. This classification included three levels: simple labels that indicate a sustainable delivery option without further context, CO_2 statistics that provide quantitative data on the environmental impact of different delivery choices, and explanatory information that explains why one option is more sustainable than another. In addition to classifying nudges, the methodology, key findings, and conclusions of each paper were systematically summarised in Table 1, offering a clear overview of how nudging has been studied in the literature and the extent to which informational nudges have been found to be effective.

3.2. Nudging in deliveries and returns

Factors such as convenience, cost, and cognitive load often direct consumers to less sustainable choices, with entrenched habits and established consumption patterns further overshadowing environmental considerations (Nijssen et al., 2023). To address these challenges, research underscores the importance of nudging as a behavioural intervention used to influence decision-making (Mertens, Herberz, Hahnel, and Brosch, 2022). In the field of sustainable delivery, the potential of nudging is also increasingly researched. In this overview of literature, we make a distinction between literature on e-commerce deliveries and e-commerce returns as they involve different considerations.

3.2.1. E-commerce deliveries

Literature on sustainable delivery decisions typically focuses on two nudging strategies: sustainability information and monetary incentives. Here, sustainability information nudges tap into consumers' intrinsic desire to act sustainably by emphasising carbon saving or ecological footprint. Price incentives, by contrast, appeal to extrinsic motivation, offsetting the extra effort required by consumers for picking or waiting longer. In extant literature on nudging, it is often argued that despite the effectiveness of extrinsic nudging, it tends to spark only short-term compliance, which slips back, or becomes even worse, once the monetary incentive stops as the incentive has displaced people's reasons for acting green (Winkler-Schor and Brauer, 2024; Rode, Gómez-Baggethun, and Krause, 2015; Kemigisha, Babweteera, Mugisha, and Angelsen, 2023). Instead, many scholars now focus on intrinsic motivators as a drive for lasting, sustainable behaviour. This review specifically considers papers that investigate nudges appealing to intrinsic motivation, like CO_2 feedback, ecolabels, and sustainability explanation.

In Table 1, we provide an overview of the papers investigating nudges to encourage sustainable last-mile deliveries. We classify the nudges used in these papers in three levels: (1) a simple label (e.g., a green leaf); (2) CO_2 information; (3) an explanation why an option is greener. As can be seen in Table 1, the literature mostly investigates nudges that give information about the CO_2 savings from sustainable delivery, but both labels and sustainability explanations also receive significant attention.

The literature suggests a consensus that consumers are more inclined to select sustainable delivery options when nudged with sustainability information or monetary incentives (Table 1). Only one paper, Amaya et al. (2025), finds that sustainability information does not result in more sustainable delivery choices. They, on the other hand, do find that disclosing vehicle type (diesel versus low-emission) does result in more sustainable deliveries, which might suggest that, to some extent, this vehicle type crowds out the effect of CO_2 information. The authors indeed note that they expect that consumers will better understand how these low-emission vehicles are considered more beneficial to the environment, and thus, vehicle type in their case is a more effective sustainability nudge.

Table 1: Overview of academic articles on the use of nudging for sustainable delivery

Source	Methodology and sample	Nudge type[1]	Sustainable delivery option[2]	Main findings
Agatz et al. (2021)	DCE with real incentives, with 1032 subjects from the U.S.	Sustainability 3 and monetary	Green time-slot	Green labels are effective, but monetary incentives offer little added value.
Amaya et al. (2025)	SPE with 1050 subjects from the U.S.	Sustainability 2 and monetary	Pick-up point	Sustainability information is ineffective, but delivery vehicle-type information is effective.
Belvedere et al. (2024)	DCE with 750 subjects from IT and 306 from DE	Sustainability 2	Pick-up point	Sustainability information is effective.
Biancolin and Rotaris (2024)	SPE with 1204 subjects from IT	Sustainability 2 and monetary	Pick-up point	Sustainability information and monetary incentives increase WTP.
Buldeo Rai et al. (2021)	DCE with 403 subjects from BE	Sustainability 3, default, sharing, and norm	Postponed delivery	Sustainability information, sharing, and social norms are effective. Default has limited effects.
Buldeo Rai et al. (2019)	CBCE with 1000 subjects from BE	Monetary	Postponed delivery and pick-up point	Monetary incentives are effective
Caspersen et al. (2022)	DCE with 460 subjects from NO	Sustainability 2	Postponed delivery	Sustainability information increases females' WTP.
Caspersen and Navrud (2021)	DCE with 513 subjects from NO	Sustainability 2	Postponed delivery	Sustainability information is effective for females
Cheah and Huang (2022)	DCE with 188 subjects from SG	Sustainability 2 and monetary	Postponed delivery and boat vs. plane	Sustainability information and monetary incentives are effective.
Dietl et al. (2024)	DCE with 323 participants from DE, AT, and CH.	Sustainability 2 and monetary	Postponed delivery	Sustainability information and monetary incentives are effective.
Ignat and Chankov (2020)	SPE with 248 subjects from DE	Sustainability 2, social impacts and monetary	Postponed delivery	Sustainability information and social sustainability information and monetary incentives are effective.
Kokkinou et al. (2024)	DCE with 226 subjects from NL	Sustainability 3 and monetary	Postponed delivery and pick-up point	Sustainability information and monetary incentives are effective.
Nijssen et al. (2023)	Randomized control trial (RCT) with real incentives and with 1213 subjects from NL	Sustainability 1 and 2 and default	Pick-up point	Default and Sustainability information are effective. Detailed info reduces most polluting choices.
Poliori et al. (2018)	SPE with 350 subjects from IT	Sustainability 1	Generic sustainable option	Sustainability information increases WTP.
Stöckigt et al. (2018)	CBCE with 149 subjects from DE	Sustainability 1 and job conditions	No clear option	Sustainability information and social sustainability impact information is effective.
Thomas et al. (2022)	DCE with 228 subjects, nationality unknown	Sustainability 1, 2 and monetary	Postponed delivery	Sustainability information and monetary incentives are effective.
Viet et al. (2023)	DCE with 348 subjects from NL and 1397 from the U.K.	Sustainability 3 and job conditions	Postponed delivery	Sustainability information is effective.

[1] We do not distinguish between surcharges and discounts because both similarly lead to a price incentive for the sustainable option.

[2] Pick-up point refers to any delivery option that results in consumers picking up their own package (parcel point, store pick-up, parcel locker).

To draw these conclusions, studies primarily examine the impact of nudges on willingness to use (WTU) and willingness to pay (WTP) for sustainable deliveries using Stated Preference (SP) methods, particularly Discrete Choice experiments (DCE) and Choice-Based Conjoint experiments (CBCE). In Figure 1, we summarise the effectiveness of nudges in WTU studies. Here we see that without nudging, in the *control group*, few participants opt for sustainable delivery. In this group, we assume most consumers are unaware that there even is a greener delivery option. As can be seen in Figure 1, once some form of information is provided, either level 1, 2, or 3, studies observe increased adoption of the sustainable delivery option. It is assumed in these cases that the information makes consumers aware of and feel responsible for the environmental consequences of their decisions, and hence feel more inclined to choose sustainably. Still, there might be groups of people that are not motivated by such information, which explains why, in for example Kokkinou et al. (2024), we see that the proportion of people choosing sustainable delivery is highest when both monetary incentives and sustainability information are offered.

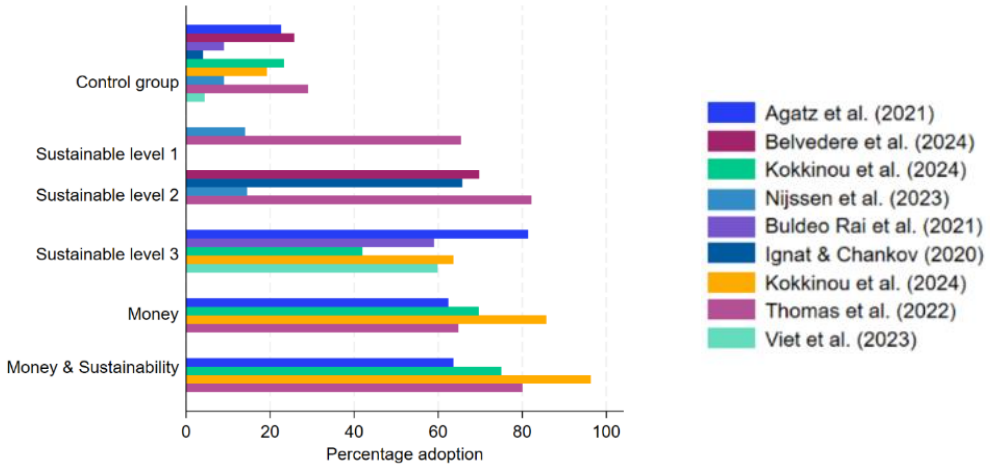

Figure 1. Nudge effectiveness in academic literature[3]

While studies examine different types of nudges, they consistently focus on the same sustainable delivery options; pick-up points or postponed delivery. Other options, like electric vehicles or cargo bikes, are considered in only two papers. The focus on postponed delivery and pick-up points likely stems from two reasons. First, they demand more effort from consumers, making them a stronger test of a nudge's effectiveness. Second, their lower cost makes firms more likely to offer them.

3.2.2. E-commerce returns

Besides e-commerce deliveries, literature has recently also focused on how informational nudging can help in limiting the amount of returns. Albeit less extensive, this literature also finds that informational nudging can be an effective way to encourage sustainable behaviour. In Von Zahn et al. (2024), a field experiment is conducted in which they find that sharing the negative

[3] Papers are ordered according to the type of delivery option: the first paper uses green time-slot, the next three use pick-up point, and the last five use postponed delivery. Kokkinou et al. (2024) is listed twice as this paper investigates both pick-up points and postponed delivery, hence we show the percentage adoption found for both.

environmental consequences of product returns can significantly reduce the amount of returns without negatively impacting sales. In their paper, they highlight the potential of "smart nudging", personalising nudges based on consumer heterogeneities. Rauh, Straubert, and Sucky (2024) similarly find that using green nudges, in the form of showing environmental impact, can result in fewer product returns. Furthermore, they find that aside from lowering the amount of returns, their sustainability nudge also resulted in a lower purchase intention overall, which suggests that sustainability nudging may negatively impact sales.

Contrary to sustainable delivery decisions, in the extant literature on nudging to limit product returns, we mostly see an informational focus on product characteristics rather than the sustainability impact of returns. For example, Ghose, Lee, Nam and Oh (2023) find that nudges that focus on helping consumers make better choices, self-assurance nudges, have both short-term (high sales) and long-term (few product returns) benefits. In their paper, they contrast such self-assurance nudges to pressure-oriented nudges, such as quantity scarcity, time scarcity, and social persuasion, for which they find unfavourable long-term outcomes in the form of higher product returns. Similarly, Martínez-López, Li, Feng, Liu, and Sansó-Mata (2022) find that returns can be avoided by using purchase risk notices, short messages that alert shoppers that the item they are about to buy could differ in appearance or fit from what they saw online, nudging them to re-evaluate the purchase. Besides risk notices, Sin, Harris, Nilsson, and Beck (2025) also argue that encouraging consumers to reflect on their purchases can help in curtailing returns.

In sum, to limit returns, literature generally investigates two types of nudges: sustainability information and product information nudges. The first creates awareness about the impact of returns and, as a result, encourages consumers to re-evaluate whether they want to really purchase the items in their basket, whereas the second gives consumers information about the product, which helps make consumers more confident about their purchase and, in this way, reduces return likelihood.

3.3. Theoretical foundation

Informational nudging has been extensively studied as a powerful mechanism for encouraging consumers to make more sustainable delivery and return choices. To understand its effectiveness, we examine the various theoretical perspectives explored in the literature in this field.

First, a key argument in favour of informational nudging is its role in knowledge creation. Many studies highlight the strong link between environmental knowledge and sustainable consumer behaviour (Belvedere et al., 2024). Here, environmental knowledge can influence behaviour as it results in understanding that allows individuals to better handle issues than uninformed individuals (Arcury, 1990; Bamberg, 2003). In a similar vein, Ignat and Chankov (2020) argue that many consumers default to the cheapest and most convenient delivery option, not necessarily out of disregard for sustainability but due to a lack of transparent information on the environmental impact of their choices. By filling this information gap, businesses can empower consumers to make more sustainable decisions (Kokkinou et al.; Buldeo Rai et al., 2019). In fact, research indicates that knowledge is a prerequisite for consumers' intention to act sustainably (Kostadinova, 2016; Kaiser et al., 1999). Given that consumers' awareness of the environmental

impact of last-mile deliveries remains low (Buldeo Rai et al., 2019c; Pernot, Phillips, and Saghafian, 2025), providing relevant information is one of the most effective non-financial incentives to promote greener choices (Buldeo Rai et al., 2021; Ignat & Chankov, 2020). Another, yet related, reason why informational nudging is argued to be effective is that it fosters intrinsic motivation by helping consumers see the value of sustainable behaviours (Winkler-Schor and Brauer, 2024). Agatz et al. (2021) suggest that when individuals receive green information about specific activities, they may align these actions with their values, making them more motivated to engage in environmentally friendly behaviours.

Informational nudging also addresses cognitive barriers that prevent sustainable decision-making. According to Trudel (2018), consumer decision-making is governed by two psychological processes: one that makes automatic, habitual choices and another that carefully analyses available information. Because sustainability concerns often feel abstract, uncertain, or distant in time, consumers may struggle to prioritise them in their decision-making (Trudel, 2018). However, research shows that making sustainability consequences tangible, such as presenting environmental impact in terms of CO_2 emissions, can enhance consumer awareness and motivation (Buldeo Rai et al., 2021). This aligns with the argument by Thomas et al. (2021), who, drawing on Social Exchange Theory, suggest that informational nudging enhances decision-making by clarifying costs and benefits. For example, by making the environmental impact of delivery or return choices more transparent, consumers are better equipped to consider these factors in their decisions.

In summary, the literature suggests that informational nudging is a promising tool for promoting sustainable delivery and return choices because it enhances consumer knowledge, fosters intrinsic motivation, helps overcome cognitive biases, and helps decision-making. Thus, given its effectiveness, many argue that informational nudging is an effective, low-cost alternative to monetary incentives. Here, scholars argue that informational nudging functions as a simple communication tool that reshapes consumer demand toward sustainability without necessitating substantial investments in new infrastructure or logistics (Thomas et al., 2022; Ignat and Chankov, 2020; Buldeo Rai et al., 2021). Given the ease of implementation and the low cost involved, scholars argue that informational nudging likely faces lower resistance from firms.

4. State of Practice

To get an understanding of the current state of practice and to evaluate how this compares to what is found in the literature, we conducted a two-stage review of the state of practice. First, we used web scraping to get a general overview of whether e-commerce companies offer sustainable delivery options and to what extent they use nudging. Second, we complement this analysis with interview insights to get an understanding of how e-commerce companies, regulators, and logistics experts view the use of nudging to encourage sustainable choices.

4.1. Web scraping results

Web scraping is increasingly used in e-commerce studies to systematically collect data from the web (Henrys, 2021; Boegershausen, Datta, Borah, and Stephen, 2022). To assess the degree to which nudging, particularly informational nudging, is currently applied in real-world e-commerce settings, we used manual web scraping of e-commerce websites. An overview of the screenshots taken during this process can be found in Appendix B. The analysis focused on the leading online retailers across multiple European markets, providing empirical data on the extent of sustainability-related nudging in practice. The study examined the top ten e-commerce companies in seven European countries: Austria, Belgium, Greece, Poland, Spain, Sweden, and the Netherlands. These countries were selected to ensure a diverse sample that captures variations in regulatory environments, consumer expectations, and corporate sustainability commitments. The companies selected per country were the top 10 largest e-commerce companies in terms of revenue. The selection of these companies was based on rankings from Statista 2022. This approach ensured that dominant market players were included in the analysis, thereby offering a view of companies that likely have at least the resources to invest in sustainable delivery options.

For each of the 70 e-commerce websites examined, we assessed whether sustainable delivery options were available and, if so, whether any form of nudging was used to promote these options. Here, we consider whether companies offer either of two sustainable delivery options: postponed delivery (i.e., slower delivery) or pick-up point delivery. Both these options have been argued to be more sustainable in the literature as they allow for consolidation. To illustrate, when consumers agree to postponed delivery, companies have more opportunity to consolidate packages that need to go to the same location and similarly, pick-up points directly allow for consolidation as many packages are dropped off at the same point.

In case nudges are observed with the delivery options, the nudges were classified using the same three-tiered approach applied in the literature review to allow for direct comparison between theoretical insights and real-world implementation. Important to note is that in this sample, we make a distinction between e-tailers (63 out of 70 in the sample) and grocery retailers (7 out of 70 in the sample), given that these online grocery retailers involve distinct considerations, as they manage logistics in-house and thus have economic incentives to encourage cost-saving, sustainable delivery options.

One important methodological consideration in this part of the study was the need to input postal codes to access delivery options. To ensure consistency, postal codes from large cities were used across all countries, which may have introduced an upward bias in the findings. Sustainable delivery options are often more prevalent in urban areas compared to rural locations due to logistical constraints. This is particularly relevant in countries such as Sweden, where

sustainable delivery is significantly less common in sparsely populated regions. This potential bias is acknowledged in the analysis, recognising that the actual availability of sustainable delivery options may be even lower in less densely populated areas.

4.1.1. Delivery options

Aggregated Results

Out of the 70 companies we analysed, 23 offer only one standard delivery option (usually 1-2 day home delivery). This means approximately one-third of e-tailers don't offer an option that could be regarded as sustainable. The other 47 companies offer an alternative delivery option that, under specific circumstances, like walking to a pick-up point, could be more sustainable. Here we see that all grocery retailers offer a sustainable option, which indicates that 37% of e-tailers do not give consumers a sustainable choice. Some e-tailers offer delivery by a low-emission vehicle, a sustainable delivery option considered in only two papers (see Table 1).

Country-specific results

Zooming in to the country level, we see that for each country, the number of companies offering sustainable delivery options ranges between 6 to 8 out of 10 (see Table 2). This is to some extent a surprising result, as one might expect more heterogeneity between these countries, especially given the differences in policy environments, consumer awareness, and logistics infrastructure across Europe. The relative uniformity in availability can, however, be partially explained by the fact that several major international retailers, such as IKEA, Zalando, and Apple, are present in the top 10 e-commerce companies in multiple countries. These companies typically offer a standardised range of delivery options across markets, including sustainable alternatives such as pick-up points or postponed delivery, which helps explain the consistency in availability.

Table 2: Availability of sustainable delivery options (In total, 10 companies per country)

Country	Postponed delivery only	Pick-up point only	Both postponed delivery and the pick-up point	No sustainable option	% that offers a sustainable alternative
Austria	3	3	0	4	60%
Belgium	0	4	3	3	70%
Greece	1	6	0	3	70%
Netherlands	1	3	3	3	70%
Poland	0	4	2	4	60%
Spain	1	5	0	4	60%
Sweden	1	7	0	2	80%

4.1.2. Sustainability communication

Aggregated Results

For the retailers that offer a sustainable option (47 out of 70), only 13 provide some sustainability information, which in most cases is limited to generic phrases like 'fossil free' or 'eco'. Noticeably, out of these 13, four are grocery retailers (out of seven grocery retailers in the sample), which involve distinct considerations, as they manage logistics in-house and thus have economic incentives to encourage cost-saving, sustainable delivery options. For the nine e-tailers that

provide sustainability information, we categorise the level of information. This analysis shows that five out of the nine rely on only simple green labels (sustainability level 1) to convey sustainability information. In contrast, two offer only CO_2 emission statistics, one offers only sustainability information, and the last one uses a mix. In practice, we thus see a tendency towards simpler nudges rather than the more detailed nudges explored in academic studies. More generally, when looking at the 63 e-tailers in the sample, our analysis suggests that sustainability information nudging is only used to a very limited extent; only 23% of e-tailers offering sustainable delivery gave some indication that this option is more sustainable.

Contrary to the limited use of sustainability nudges, we do observe that more than half (i.e., 25 out of 40) of e-tailers offer monetary incentives for their alternative delivery options. These findings are somewhat surprising considering the results found by Agatz et al. (2021), who found that price incentives add little value beyond sustainability information. Following this reasoning, companies should, in theory, avoid varying delivery prices in general, as consumers are highly sensitive to costs and may abandon purchases if their preferred option is costlier (Buldeo Rai et al., 2021). If these arguments from research indeed hold up in practice, it should be more financially advantageous to use sustainability nudges rather than monetary incentives.

Country-specific results

Despite the relatively consistent availability of more sustainable delivery options across different countries, there is a notable disparity in how, and whether, these options are communicated to consumers. In countries such as Greece, Poland, and Spain, none of the companies made any reference to sustainability in their alternative delivery options, even though 19 out of 30 companies in those markets do offer a more environmentally friendly alternative. This contrast highlights that the presence of sustainable choices does not necessarily translate into sustainability communication or nudging. In fact, within our sample, informational nudging strategies are used almost exclusively in Western and Nordic European countries. Table 3 illustrates this uneven distribution: while countries like Sweden and the Netherlands show high adoption of both informational nudges and monetary incentives, no such informational nudges are present in Southern and Eastern countries.

This regional pattern is further visualised in Table 3, which breaks down the use of sustainability communication and incentives per country. The findings suggest that while infrastructure for sustainable delivery may exist across Europe, the behavioural cues that encourage consumers to make greener choices are at this point mostly employed in Western and Northern Europe. Here, it is important to note that these results are solely based on what e-commerce companies present and disregard the logistics provider. It may thus be that consumers still experience nudging but simply not in the checkout stage. In Poland, for example, InPost, a logistics service provider, communicates about sustainability to consumers and encourages these options by offering insights into the CO_2 savings realised by selecting a parcel locker.

Table 3: Nudging used for sustainable delivery option (In total, 10 companies per country)

Country	Sustainability Nudge only	Monetary Nudge only	Both Sustainability and Monetary Nudge	No nudging
Austria	2	2	0	6
Belgium	0	3	1	6
Greece	0	5	0	5
Netherlands	0	1	4	5
Poland	0	3	0	7
Spain	0	4	0	6
Sweden	0	3	5	2

4.1.3. Return options

Over the past decade, European consumers have come to expect returns that are convenient and free of charge. This expectation has been shaped largely by major e-commerce players' generous return policies. Hence, for many shoppers today, the ability to return products easily and free of cost is not a luxury but a standard feature of online shopping. Indeed, free returns lead to an increase in post-return purchases and order frequency (Bower and Maxham, 2012; Lantz and Hjort 2013). On the one hand, this is a positive development. Hassle-free, costless returns are a critical safeguard for consumers who cannot physically inspect products before buying. Such return policies ensure that shoppers are not penalised for receiving faulty or unsuitable items and support trust in the digital marketplace. Thus, from a consumer rights perspective, the right to return is essential to maintaining fairness and confidence in e-commerce (European Union, 2011). On the other hand, no-cost returns have also led to unintended consequences in consumer behaviour. It has contributed to a culture of over-ordering, where shoppers routinely purchase multiple items, often in different sizes, colours, or styles, intending to return most of them (Chen, Tan, and Wang, 2024). This practice, often referred to as a bracketing purchase, places considerable strain on retailers' reverse logistics, increases operational costs, and raises concerns about the environmental impact of unnecessary shipping and repackaging (Jack, Frei, and Krzyzaniak, 2019; Zhang, Frei, Wills, Gerding, Bayer, and Senyo, 2023).

In the past few years, a trend towards paid returns has emerged. At this point, nearly half of e-commerce companies offer free returns, but increasingly more companies are starting to charge money for returns (Mollie, 2022). For example, Zara, Boohoo, and Uniqlo, all major fashion retailers, started charging returns to fight the high costs of returns and to reduce emissions. As increasingly more e-commerce companies start charging for returns, other initiatives that try to limit returns are also implemented. Here, many companies have started to provide more product information on their websites to help consumers make well-informed choices, and with that, limit returns. A key strategy is the improvement of product detail pages. Retailers now invest heavily in high-quality images, 360-degree views, videos, and detailed specifications. In categories like fashion, this includes advanced sizing tools, fit prediction algorithms, and photos of models with different body types. The goal is to reduce uncertainty and help customers choose the right item the first time, minimising size mismatches and unmet expectations. The use of environmental messaging to limit returns is, however, hardly used. In an evaluation of large e-tailers, we see that nearly no firms communicate about the environmental impact of returns, while product detail is provided by nearly all e-tailers.

4.2. Interview results

To gain further insights, expert interviews were conducted with key stakeholders, including regulatory authorities, e-commerce companies, and logistics experts. These interviews provided qualitative insights into the barriers that prevent firms from adopting sustainable delivery options and informational nudges. A diverse sample of interviewees was selected to ensure multiple perspectives on the issue, with a particular focus on understanding the industry's reluctance to implement nudging strategies.

One potential limitation of the interview-based approach is the risk of upward bias, as many of the selected experts were already engaged in sustainability initiatives and may have expressed greater enthusiasm for sustainable delivery solutions than the broader industry. However, this bias is not considered problematic in the context of the study, as the web-scraping analysis already suggests low levels of informational nudging in practice. If anything, the actual rate of adoption in the industry may be even lower than the perspectives captured in the interviews, reinforcing the findings of the web scraping analysis.

Our interviews with different stakeholders reveal two interconnected barriers to sustainable delivery uptake: the limited availability of sustainable delivery options, and the weak or absent communication of these options to consumers.

4.2.1. Sustainable options

As noticed in the web scraping, about half of the companies do not offer a sustainable delivery option. Dietl, Voigt, and Kuhn (2024) and Thomas, Ueltschy, Murfield, and Elram (2022), however, argue that it might be a cost-effective way to differentiate yourself from your competitors, and hence the question arises as to why many companies do not offer alternative delivery options.

From interviews, we found that the reason that many companies do not offer sustainable delivery options might be the perceived imbalance between investment, costs and commercial return. While pick-up points often cost no more to operate than home delivery, implementing these options at checkout requires substantial technical work. One logistics stakeholder explained: "If you [an e-tailer] build the checkout yourself, you'll run into a caching issue that makes retrieving pick-up points take three seconds. When you keep a customer waiting those extra seconds, your conversion rate drops." (Interview 4). Even slight delays are known to negatively affect conversion (Stadnik & Nowak, 2018), making performance-critical checkout functions a high-stakes area for change.

This problem is compounded by infrastructure limitations. Many retailers lack the backend systems to accommodate postponed delivery or alternative fulfilment models: "Only a small percentage of our customers have a Warehouse Management System with which they can postpone deliveries." (Interview 4). Smaller retailers often find these upgrades too costly, and logistics providers do not typically offer pricing incentives that would make greener delivery financially attractive.

The final obstacle cited was the inability to recoup costs through consumer pricing: "At the end of the day, they all fear the additional costs, [...] They cannot forward any additional costs to the consumers, because they will choose other cheaper options." (Interview 1). Tokar et al. (2020) similarly found that consumers are often unwilling to pay extra for delivery, even when they express preferences for greener options.

4.2.2. Sustainability communication

While offering more sustainable delivery options might already be a hurdle for companies, communicating them presents an additional layer of complexity. Interviewees made clear that many companies choose not to communicate about sustainability because of reputational risk and regulatory uncertainty. As one respondent noted, "Companies who are trying to be sustainable are unfairly treated because either they're treated similarly as companies with unsubstantiated claims or consumers don't trust either." (Interview 2). Others echoed the concern that, "Due to widespread misleading sustainability claims, consumers struggle to make sustainable choices, and companies with genuine efforts cannot distinguish themselves." (Interviews 5 and 7).

In anticipation of forthcoming legislation on sustainability claims, some firms have also adopted a wait-and-see strategy. As one interviewee explained: "We have already calculated emissions… but we do not communicate it because we are waiting for a European standard to avoid confusion and unnecessary costs." (Interview 3). This temporary retreat from sustainability messaging is related to the concept of greenhushing: "the deliberate withholding, from customers and stakeholders, of information about the sustainability practices that they employ" (Font, Elgammal, and Lamond, 2017). Interview 5 revealed that companies might refrain from disclosing sustainability information to avoid potential backlash from consumers who do not believe their information. This effect mostly persists due to a lack of regulation and no one official system to verify claims.

Aside from regulatory risks, consumers might also not behave exactly as the nudging literature expects them to behave. In the interviews, interviewees described consumers that could fall into the attitudinal profilers proposed by Cauwelier et al. (2024): the careless consumer, the uncommitted consumer, the ignorant consumer, and the pro-sustainable consumer.

In the interviews, e-commerce companies repeatedly refer to consumers with low awareness and only moderate individual concern for sustainability, resulting in inaction. This consumer type is closely related to Cauwelier et al. (2024), their ignorant consumer. One interviewee noted that "they just do not know, nor realise [what is sustainable]" (Interview 4). This was later echoed by Interview 6. This supports findings from behavioural literature showing that increasing knowledge is often a prerequisite for behaviour change (Peschel et al. 2016; White et al. 2019; Gifford and Nilsson 2014). The uncommitted consumer is paralleled in our interviews with a consumer described as skeptical, consumer who are aware but do not act because of their distrust in the presented sustainability communication: "Some consumers don't know who to trust anymore and hence don't even base their decision on these [green claims] anymore." (Interview 2). The careless consumer is also somewhat described in interviews when companies repeatedly pointed out that only information is not enough to change behaviour, they had to implement monetary incentives to see behavioural change in most consumers.

Interestingly, while the pro-sustainable group in Cauwelier et al. (2024) represented about 22% of the population and showed higher willingness to use sustainable delivery options, interviewees rarely mentioned this consumer explicitly. This absence may have multiple explanations. One possibility is that these consumers are already engaged and therefore perceived as less in need

of targeted communication efforts. Another explanation might be that some companies hold implicit assumptions that consumer demand for sustainable delivery is low, reinforcing internal narratives that reduce the urgency to invest in more sustainable delivery options or communication strategies.

5. Overview of Best Nudging Practices

Given the state of practice in which communication is only employed to a limited extent, we conducted a further analysis of best practices around Europe and reviewed the literature on the concept of nudges to formulate guidelines for nudging.

The concept of nudging originates from behavioural economics, particularly from the work of Thaler and Sunstein (2008), who define a nudge as any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. In the context of sustainable delivery, nudges can subtly guide consumers toward sustainable delivery options by attempting to make this choice visible or attractive. Generally, we can divide nudges into two categories: Intrinsic and extrinsic nudges; those that appeal to internal motivation versus those that offer external incentives like money.

Intrinsic nudges aim to activate people's internal values, norms, and sense of purpose. These nudges are most effective when they provide meaningful information that connects the individual's action with a desirable outcome. For instance, telling consumers that choosing a parcel locker delivery saves 20% of CO_2 emissions on the last mile appeals to their intrinsic motivation to behave in pro-environmental manners. These types of nudges draw on psychological theories such as expectancy theory (Vroom, 1964) and norm activation theory (Schwartz, 1977). Extrinsic nudges, by contrast, influence behaviour by altering the external payoff structure. These include monetary rewards, loyalty points, or price incentives that directly compensate the user for choosing a greener option. In this case, offering a discount for a pickup point effectively offsets the disutility from having to go to the pickup point.

In the following section, we rely on behavioural theories and best practices from around Europe to inform guidelines on nudges. At this point, web scraping already revealed that relatively few firms in Europe communicate clearly about sustainable delivery options, and our interviews confirmed that such communication often faces various obstacles. Yet, despite these obstacles, several companies stand out by effectively implementing nudging aimed at encouraging more sustainable deliveries. We evaluated a set of such frontrunners and compiled best practices that illustrate how to make sustainable delivery options both visible in a manner that is viable for companies. In the evaluation of best practices, we focus on the same countries as were the focus for the web scraping to see where the frontrunners are. The best practices came forth from discussions with consortium members from these respective countries who are familiar with the e-commerce climate.

5.1. Making sustainability tangible

A central principle that came forth in our evaluation of best practices is the importance of making sustainability tangible and understandable to consumers. More specifically, companies should apply nudging by showing consumers the concrete benefits of their actions. From a psychological perspective, this insight fits common behavioural theories. For example, expectancy theory suggests that people are motivated to act when they believe their action will lead to a desirable and attainable outcome (Vroom, 1964). Here, a concrete statement on the expected outcomes of certain choices works to motivate individuals to choose that option. Moreover, norm activation theory (Schwartz, 1977) further explains that when people are made aware of the consequences of their behaviour and are shown how their choices reduce harm,

they are more likely to act in accordance with their personal norms, especially in pro-social contexts like environmental protection (Thøgersen, 2006).

InPost, a Polish logistics provider, is a good example of how such nudging can be applied. Through their app, customers receive immediate feedback on the environmental impact of their delivery choice. For example, after selecting a parcel locker, users are informed: *"The delivery of this package generated 94.6% less CO_2 on the last mile compared to our home delivery."* By presenting emissions in specific terms, 0.02 kg CO_2 for locker delivery versus 0.363 kg for home delivery, InPost removes the abstraction from sustainability. This message is delivered in a conversational, friendly tone, reinforcing the idea that choosing the greener option is both responsible and easy. Another fitting example is from PostNL in the Netherlands, which shows a green leaf next to pick-up points and nudges consumers towards these options by stating: *"The delivery person delivers your package in one go together with all kinds of other packages. This way we travel fewer kilometres and save CO_2"*. The personalised tone in these messages psychologically encourages people to select this option to do their part in reducing emissions.

Another way to make emissions more tangible and understandable is employed by Geopost, which has taken a data-driven approach to sustainable delivery by providing its customers with concrete, accessible information about the environmental impact of their shipping choices. At the core of this effort is the Geopost Carbon Calculator, a tool launched to give clients shipment-specific carbon footprint estimates. The system is in line with the Global Logistics Emissions Council Framework. The tool can provide a strong behavioural nudge as companies learn of the emissions produced from different delivery options and thus overcomes an issue that came forth in interviews, which is that many e-commerce companies do not know the emission impacts of various delivery options. The logistics provider DPD has already implemented this tool in 18 countries across Europe.

Ingrid, a Swedish company that designs checkouts for e-commerce companies, illustrates how sustainability can be made tangible through subtle, effective nudging techniques in the e-commerce checkout process. Ingrid helps retailers embed sustainability into the design of choices by making greener delivery options more visible, understandable, and emotionally rewarding. The interface supports this with concise, benefit-focused labels like *"Climate-compensated delivery"*, accompanied by brief pop-up explanations that clarify the environmental value of the option. On their website, they show that Kronans Apotek achieved 25% more green deliveries after implementing Ingrid's checkout design, suggesting that their method of nudging consumers is effective.

Finally, in interviews we conducted, as well as in interviews conducted in the CodeZero project (Pernot, Phillips, and Saghafian, 2025), it became clear that consumers struggle to understand exact CO_2 savings and that they generally are not aware of the environmental impact of delivery. Therefore, making sustainability information tangible and easy to understand may encourage consumers to make more sustainable delivery and return decisions.

5.1. Positive framing

Aside from the importance of tangibility, how sustainability is communicated also matters for its effectiveness. Our analysis of European frontrunners, coupled with behavioural theory, makes a compelling case for positive framing as the most effective and commercially viable strategy for promoting sustainable delivery.

From a psychological standpoint, positive framing aligns with the idea of warm glow originally proposed by Andreoni (1989). The idea behind this is that people may experience psychological benefits from prosocial behaviour. This concept has also been argued to motivate proenvironmental behaviour, since individuals may experience a feeling of warm glow from contributing to emission saving (Kahneman and Knetsch, 1992; Nunes and Schokaert, 2003). In line with this theory, people can thus be argued to behave more prosocially if they believe they are 'doing good', which vouches for positive framing of sustainability communication. Furthermore, Spence and Pidgeon (2010) also argue for positive framing to encourage proenvironmental behaviour as they find that gain-framed messages were found to be more effective than loss-framed ones in fostering positive attitudes toward climate change mitigation, while also heightening the perceived seriousness of its impacts.

On the other hand, prospect theory (Kahneman & Tversky, 2013) suggests that people are more sensitive to potential losses than to gains. This principle is often used to vouch for negatively framed messages, but in our context, negatively framed messages come at a clear cost. To illustrate, in interviews, stakeholders referred to consumers being skeptic of environmental messaging because they did not know whether they could believe it. Moreover, in a consumer study by Mintel (2021), it also became clear that consumers hold companies mostly responsible for sustainability issues; hence, negative framing might be received as companies try to avoid responsibility. Thus, in the online shopping context, where convenience and trust are critical to conversion, loss-based framing can backfire by disrupting the customer experience or triggering resistance.

This approach of positive framing is reflected in best practices from across Europe. InPost in Poland communicates the environmental benefits of using parcel lockers directly in their app, telling customers, *"Thank you for choosing such an eco-friendly delivery option!"* Similarly, Belgian logistics provider bpost supports merchants with standard language that reinforces the benefit of sustainable delivery options: *"Did you know that delivering your orders to a bpost pick-up point or parcel locker reduces the CO_2 emissions of your shipments by an average of 30%?"* This type of message invites action through a lens of opportunity rather than sacrifice. It reassures customers that they are making the right choice without inducing fear or guilt.

Another example from an e-commerce company is the Swedish NetOnNet, which provides a clear example of how positive framing can be effectively used to promote sustainable delivery choices. Instead of warning users about the environmental impact of less sustainable options, the interface highlights the *benefits* of green choices using affirmative labels like "Nordic Ecolabelled delivery" and "Fossil-free delivery." When expanded, the ecolabel description explains that the option meets high standards for energy efficiency, use of renewable fuels, and fair working conditions, without invoking guilt or blame. Here, by selecting a sustainable option, a feeling of warm glow is expected to arise (Hartmann et al. 2017).

Finally, positive framing is also important because, as Rauh, Straubert, and Sucky (2024) found, green nudges may result in a lower purchase intention overall, which suggests that sustainability nudging may negatively impact sales. Therefore, it is important to frame nudges positively to appeal to positive emotions and, with that, minimise the negative impacts on sales.

5.3. Rewarding sustainable choices

Rewarding sustainable delivery choices through points or financial incentives can be effectively explained using utility theory. In classical economics, utility refers to the satisfaction or benefit a consumer gains from a product or choice. When making decisions, individuals weigh the total utility of each option, which includes both positive outcomes (such as environmental benefits or financial rewards) and negative aspects (such as inconvenience, effort, or time costs). For sustainable delivery, consumers often perceive a cost in utility; they might need to wait longer, travel to a pick-up point, or give up the convenience of home delivery.

This is where monetary rewards or point-based systems, like InPost's InCoins, become crucial. These incentives act as compensatory utility; they offset the perceived disadvantages by adding an extra, tangible benefit. For instance, if choosing a parcel locker involves an additional effort (e.g., walking to the locker), earning InCoins for that action increases the net utility of the sustainable option. The reward doesn't need to be large; even small benefits could help tip the decision in favour of the greener choice. Furthermore, in the case of InPost's Ekozwroty, users who return unwanted goods via lockers for reuse or donation receive InCoins as a token of value. This additional utility can turn a behaviour that might have been seen as burdensome into one that feels smart, efficient, and rewarding.

Another example is the case of Albert Heijn, one of the largest grocery retail chains in the Netherlands. Like several other European grocery retailers, Albert Heijn employs dynamic pricing for delivery slots. In this model, the price of a delivery window is based on its logistical efficiency and environmental impact. Time slots that coincide with existing delivery routes and allow for consolidated deliveries are often cheaper or even free. In contrast, time windows that require individual trips or deviate from optimal delivery patterns cost more. For Albert Heijn, this dynamic pricing is combined with a sustainability message wherein they give the timeslot a green leaf and explain to consumers that at this timeslot they are "already in the neighbourhood".

Other Dutch grocery retailers like Jumbo and Picnic employ a similar approach, and Mercadona and Carrefour in Spain and Mathem in Sweden also employ price incentives for more sustainable delivery options, albeit they do not communicate about this. This is generally an interesting insight; many companies give a discount for pick-up points or postponed delivery, but very few communicate about it being more sustainable. We argue that this is a potential avenue for e-commerce companies to explore. Here, companies should complement the discount given with sustainability information to appeal to both rational utility increase through monetary incentives and a warm glow component. An example of an e-commerce company that combines both mechanisms is the Dutch Wehkamp, which gives a discount for pick-up points at communicate that this pick-up point is "on the daily route" whereas home-delivery causes an "extra stop". Furthermore, H&M and Elgiganten in Sweden also employ an approach where they give a discount for the sustainable option and simultaneously inform consumers that this delivery is "climate-smart"

Thus, in line with utility theory, we see that for sustainable delivery to compete with less sustainable but more convenient options, an effective approach is to try to increase the perceived utility of the green choice by offering monetary or symbolic rewards like points, discounts, or loyalty.

5.4. Social norms

Another potentially powerful strategy for promoting sustainable delivery choices lies in the use of social norms and peer comparison, a behavioural approach deeply rooted in social norm theory. This theory, as developed by Cialdini, Reno, and Kallgren (1990), argues that descriptive norms (i.e., the things that most people do) can have a strong influence on consumer behaviour by guiding people toward choices that align with the perceived actions of others. In the context of e-commerce delivery, where decisions are often low-involvement and habitual, presenting the more sustainable option as the socially common or preferred option can nudge consumers to follow the majority.

This theoretical insight has been confirmed in empirical studies, including recent work by Buldeo Rai et al. (2021), who tested the effect of non-financial behavioural nudges in e-commerce delivery. Their survey experiment demonstrated that simply informing consumers that a majority of others had chosen a sustainable delivery option significantly increased the likelihood that they would do the same. These findings underscore the core mechanism of social norm theory: behaviour is shaped not just by personal preferences or incentives, but by an individual's understanding of what is normal or expected in a social context.

Several companies are beginning to implement this insight into practice. The app Too Good To Go, for instance, uses real-time counters ("1,450 meals saved today") to show users they are part of a large-scale collective effort. In energy conservation, similar peer comparison tactics, such as showing households how their electricity use compares to neighbours, have led to measurable reductions in consumption (Schultz et al., 2007). Albeit hardly used in the context of e-commerce delivery and return, it might be an easy method to encourage sustainable choices and to foster a sense of belonging between consumers. Thus, by embedding social norm messages into e-commerce interfaces, such as stating "60% of customers in your area chose low-emission delivery", retailers can signal what is socially typical and socially approved. This approach subtly shifts consumer decision-making by making sustainable delivery the social default.

5.5. Visual cues as supporting elements

Visual cues such as icons, badges, or labels play an important role in the way sustainable delivery options are presented to consumers. They are a common form of low-friction nudging: quick to interpret, visually appealing, and capable of drawing attention to greener alternatives without overwhelming the customer with text (Vermeir and Roose, 2020; Majer, Henscher, Reuber, Fischer-Kreer, and Fischer, 2022). Our web scraping analysis shows that green leaves, trucks with eco-symbols, or climate-friendly badges are now occasionally used in checkouts across various European platforms to mark delivery options as more sustainable options. These cues function by increasing the salience of the sustainable choice, making it easier to notice and cognitively categorise as the "right" or "better" option.

However, while these visual markers can be effective in capturing attention, they come with important limitations, especially in the domain of sustainability communication. Our analysis suggests that such icons may be particularly vulnerable to consumer scepticism. In interviews, stakeholders noted growing concerns around greenwashing and superficial claims, particularly among environmentally conscious users. Without a clear explanation or supporting information, an icon alone may appear vague or arbitrary, potentially undermining the credibility of the sustainability claim. This insight is supported by behavioural research, which shows that trust

and perceived authenticity play a critical role in determining whether sustainability messages lead to action (Peattie & Crane, 2005). To mitigate this risk and increase the psychological impact of visual nudges, we recommend that icons should always be accompanied by clear, concise explanations of what makes a delivery option sustainable. Providing information on emissions reduction, route efficiency, or carbon compensation directly next to the icon can make the sustainability claim more tangible and believable, and thus more likely to influence behaviour. This aligns with earlier insights from expectancy theory (Vroom, 1964) and norm activation theory (Schwartz, 1977), which suggest that understanding the concrete impact of one's actions enhances motivation and alignment with pro-social norms.

Interestingly, our web scraping analysis showed that iconography was the most common form of sustainability communication among the companies we reviewed. In many cases, companies applied a green leaf or badge next to certain delivery slots or pick-up options, but some did not include any further explanation. While this signals that companies are aware of the need to highlight sustainable choices, it might not lead to behavioural change and may even result in scepticism given the lack of information.

In conclusion, while visual cues are a useful first step in promoting sustainable delivery, they might be insufficient on their own. Firms should view iconography as a supporting element in a broader communication strategy, one that combines clarity, credibility, and emotional appeal.

6. Survey Results

As part of the wider GreenTurn survey, we included a question designed to explore how individuals respond to different nudges aimed at promoting sustainable choices in e-commerce. This question tested how different types of messaging and incentives influence consumer motivation to choose more sustainable options.

Participants were presented with a series of hypothetical messages and incentives, for example, CO_2 savings translated into relatable terms like kilometres not driven or trees saved, and asked to rate how motivating they found each one.

To ensure a nuanced understanding of consumer responses, the analysis was segmented by demographic and geographic variables. We examined differences in responses by age, gender, and country to uncover whether certain groups are more receptive to specific types of nudges. For example, younger consumers may be more responsive to loyalty schemes or visual cues, while older respondents might respond more strongly to environmental framing. Gender-based analysis allows us to detect whether motivational patterns differ between men and women, and cross-country comparisons help identify whether cultural or regional contexts influence the effectiveness of nudging strategies. Furthermore, we also investigate whether nudges were perceived as more motivating if a person scored high on perceived importance of sustainable deliveries and packaging.

By disaggregating the data in this way, the survey not only helped to identify the most effective messages overall but also provides insights into how nudging strategies can be tailored to different consumer segments, making them more impactful, relevant, and scalable across diverse markets.

6.1. Motivational power of nudges

To begin our analysis of sustainability messaging, we first explore how motivating each individual message is perceived to be. In the survey, respondents were presented with five types of delivery-related sustainability messages (see Table 4), each framed differently, and respondents rated each message on a five-point scale from *"Not at all motivating"* (1) to *"Very motivating"* (5).

The descriptive results in Table 4 show the average motivational ratings for each message across the entire sample of 5,000 respondents.

From these results, we observe that all messages receive scores slightly above the neutral midpoint of 3.0, suggesting a generally positive perception of sustainability messaging among respondents. However, some messages score higher than others. The highest-rated message is Message 2, which highlights delivery efficiency by noting that the courier is already in the consumer's street, an appeal to practicality and shared resource use, with a mean of 3.46. Closely following are messages that localise the environmental impact: Message 4, which references improved air quality and reduced congestion (mean = 3.44), and Message 5, which uses the symbolic comparison to trees saved (mean = 3.43). By contrast, Message 1, which states a numerical percentage reduction in CO_2 emissions, is perceived as the least motivating (mean = 3.18). This suggests that abstract, data-heavy messaging may be less impactful than localised or emotionally framed messaging.

Table 4: Descriptive statistics *Messages*

Message Type	Mean	Standard deviation
Message 1: This delivery option results in a X% decrease in CO_2 emissions.	3.18	1.20
Message 2: This delivery option is more sustainable because we are already in your street on that day, so we drive fewer kilometres, which leads to fewer emissions.	3.46	1.18
Message 3: This delivery option helps reduce CO_2 emissions by X kg, which is equivalent to saving X kilometres of car travel.	3.32	1.20
Message 4: This delivery option improves the air quality in your neighbourhood and limits the congestion in the streets.	3.44	1.21
Message 5: This delivery option helps reduce CO_2 emissions by X kg, which is equivalent to saving X trees.	3.43	1.23

Moving away from descriptives, we assessed whether certain messages are significantly more effective than others. We apply a mixed-effects model to analyse how consumers rated the five different message framings. Each respondent in the survey evaluated all five message types, which introduced a within-subject structure to the data. To properly account for this, we modelled individual respondents as random effects and message type as a fixed effect. This allowed us to control for individual differences in general motivation levels while estimating the average differences in how each message was perceived.

The results in Table 5 clearly show that the type of sustainability message has a significant impact on how motivating it is perceived to be. Using post-estimation pairwise comparisons, we found that Message 2, emphasising that the courier is already in the consumer's street and therefore the delivery leads to fewer emissions, was rated significantly more motivating than all other messages. This practical and relatable framing stood out as particularly more effective, suggesting that consumers respond strongly to messages that highlight logistical efficiency and shared benefits. In contrast, Message 1, which communicated a percentage reduction in CO_2 emissions, was consistently rated the least motivating. All other messages, those translating emissions into kilometres not driven (Message 3), emphasising improved air quality and reduced congestion in the neighbourhood (Message 4), or comparing emissions saved to trees (Message 5), were rated significantly higher than Message 1. These results suggest that abstract numerical framings are less compelling than messages that offer either localised or concrete interpretations of environmental benefit.

Table 5: Pairwise comparison of *Message* effectiveness

Comparison	Mean difference	Standard Error	P-value	95% confidence interval
Message 2 versus 1	0.2816	0.0128	0.000	[0.2565, 0.3067]
Message 3 versus 1	0.1348	0.0128	0.000	[0.1097, 0.1599]
Message 4 versus 1	0.2554	0.0128	0.000	[0.2303, 0.2805]
Message 5 versus 1	0.2452	0.0128	0.000	[0.2201, 0.2703]
Message 3 versus 2	-0.1468	0.0128	0.000	[-0.1719, -0.1217]
Message 4 versus 2	-0.0262	0.0128	0.041	[-0.0513, -0.0011]
Message 5 versus 2	-0.0364	0.0128	0.005	[-0.0615, -0.0113]
Message 4 versus 3	0.1206	0.0128	0.000	[0.0955, 0.1457]
Message 5 versus 3	0.1104	0.0128	0.000	[0.0853, 0.1355]
Message 5 versus 4	-0.0102	0.0128	0.426	[-0.0353, 0.0149]

Furthermore, the statistical difference between Message 3 and Message 5 is also of interest. Although both aimed to make CO_2 savings more tangible, Message 5, which equated emissions reductions to the number of trees saved, was rated significantly more motivating than Message 3, which translated savings into kilometres not driven. This might suggest that symbolic or emotionally resonant comparisons, such as trees, which carry strong associations with nature and climate action, are more compelling than numerical or distance-based analogies. In other words, while both framings help consumers grasp the impact of their choices, symbolic messages like trees saved may foster a stronger emotional connection and sense of responsibility.

Taken together, these findings highlight that consumers are generally receptive to sustainability messages, but their motivational power depends strongly on how the information is presented. Messages that are tangible, personal, or practically framed tend to perform better than those that rely on abstract environmental metrics. This has direct implications for how e-commerce platforms should communicate sustainable delivery options to maximise engagement and encourage greener consumer choices.

6.2. Consumer segment analysis

To explore how different segments of the population respond to sustainability messaging, we analysed whether demographic characteristics such as age, gender, education, and income influence how motivating respondents find the messages overall. This part of the analysis helps us understand not just which messages work best in general, but also for whom they are most effective.

Using the total motivation score, calculated by summing each respondent's ratings across all five sustainability messages, we examined how this composite measure varies across different groups and whether some groups generally perceive messaging as more effective. Next, we also use disaggregated scores to see whether different groups preferred different messaging.

6.2.1. Determinants of message receptiveness

To better understand what drives consumers to find sustainability messaging motivating, we conducted a regression analysis using the total message score as the dependent variable. This score, constructed by summing respondents' ratings across the five sustainability delivery messages, provides a single measure of how motivating they found the messages overall. We then regressed this outcome on a set of demographic and attitudinal predictors to identify which factors influence message receptiveness.

The model included standard demographic variables such as *Country*, *Age* (in 6 levels), *Gender*, *Income* (in 6 levels), and *Education* (in 5 levels). For these variables, respondents answering "prefer not to say" for education and income and respondents with education types "other" were excluded in the presented regression analysis. To ensure robustness, the regression was also run with the entire sample and in all cases results were comparable.

The behavioural variables were complemented by several behavioural and attitudinal variables that reflect respondents' general orientation toward social and environmental sustainability in the context of e-commerce. All these attitudinal variables were measured on a scale from 1 to 5, from *"Not at all motivating"* (1) to *"Very motivating"* (5). Specifically, we included a variable indicating whether respondents value sustainable delivery (*EcoDelivery*), whether they are more likely to shop at companies that treat their staff well (*StaffWell*), whether they generally prefer sustainable products (*PreferSustainable*), and whether they are willing to spend more on sustainable options (*SpendSustainable*). We also controlled for how often respondents generally shop online by including a variable that captures how many orders they placed online in the past 2 weeks (*OrderNumber*).

We included country fixed effects to control for cultural or structural differences in sustainability awareness across national contexts. Age was included as a categorical variable, as receptiveness to sustainability messaging often varies generationally, with younger people typically showing greater concern for environmental issues (Poortinga, Demski, and Steentjes, 2023; Milfont, Zubielevitch, Milojev, and Sibley, 2021). Gender was also included, as previous research has shown that women are often more responsive to ethical and sustainability cues (Chekima, Wafa, Igau, Chekima, and Sondoh, 2016; Dhir, Sadiq, Talwar, Sakshita, and Kaur, 2021). We further expect education and income to influence respondents' ability to understand or relate to sustainability claims, as well as their willingness to act on them. The attitudinal variables, in particular, are important for understanding how pre-existing sustainability orientations relate to message effectiveness. We would expect respondents who already prefer sustainable products or are willing to pay more for them to find the messages more motivating, as these individuals are likely to be more receptive to the values being communicated. Similarly, those who value fair treatment of staff or eco-friendly delivery may view sustainability as a broader ethical concern, which could increase their engagement with the messages. We include the number of orders in past weeks to investigate whether those who order more are more or less receptive to sustainability messaging.

By including these variables together in the model, the analysis offers insight into who finds sustainability messaging effective, but also gives insights into the why through attitudinal variables. This provides an empirical basis for tailoring communication strategies to align with both demographic and value-based audience characteristics. To conduct this analysis, we use Ordinary Least Squares (OLS) to see which factors influence the motivational power of messages.

The regression model we estimated is:

$$TotalMessageScore_i = \beta_0 + \beta_1 Country_i + \beta_2 Age_i + \beta_3 Gender_i + \beta_4 Income_i + \beta_5 Education_i + \beta_6 EcoDelivery_i + \beta_7 StaffWell_i + \beta_8 PreferSustainable_i + \beta_9 SpendSustainable_i + \beta_{10} OrderNumber_i + \varepsilon_i$$

The results of the OLS regression are presented in Table 6.

The results presented in Table 6 show that personal values and attitudes toward sustainability are by far the strongest predictors of message effectiveness. Respondents who said they value eco-friendly delivery options rated the messages significantly higher, as did those who believe companies should treat staff well, prefer sustainable products, or are willing to pay more for sustainable options. Each of these variables showed a strong and statistically significant positive association with the total message score. Notably, the coefficient for the variable capturing the importance of eco-friendly delivery was particularly large, suggesting that respondents who already prioritise sustainability in the delivery process are much more responsive to related messaging.

Aside from the influence of attitudes, gender also played a significant role. Women rated the messages significantly higher than men, confirming previous findings that female consumers tend to be more receptive to ethical and environmental communication (Chekima, Wafa, Igau, Chekima, and Sondoh, 2016; Dhir, Sadiq, Talwar, Sakshita, and Kaur, 2021). Other gender categories, while included, were based on smaller subsamples and produced less precise estimates and were therefore do not analysed further.

The effect of age was mixed. Respondents in the youngest age group (reference category) were generally more responsive to sustainability messaging than older respondents, with those in the second age group showing a statistically significant decline in their total message scores. However, the effect size diminished with higher age categories, and several of the age-related differences were not statistically significant, suggesting that age-based variation exists but is not uniform.

Education level also mattered, though less consistently. Respondents with higher vocational or tertiary education (education category 4) rated the messages significantly lower than those in the lowest category. This may reflect a more critical or selective interpretation of sustainability claims among higher-educated individuals, or it may suggest that messaging needs to be framed differently to appeal to this group. Other education levels showed negative coefficients as well, though not all were statistically significant.

Country-level differences were also notable. Respondents from France and Spain, for example, gave significantly higher total message scores compared to the reference country (Austria), while those from Poland rated the messages significantly lower. These results underline the importance of cultural and contextual factors in shaping how sustainability communication is received and suggest that country-specific strategies may be necessary to maximise message impact.

Income and frequency of online ordering had no clear or consistent relationship with message effectiveness. The coefficients for income brackets were small and mostly non-significant, as was the variable capturing how many online orders respondents typically place. This suggests that message receptiveness is less about financial status or consumer volume, and more about values and personal alignment with sustainability.

Table 6: Factors influencing the motivational effect of informational nudges

Variable	Coefficient	Std. Error	t	p-value	Significant	95% Confidence Interval
Country						
France	1.7913	0.2028	8.83	0.000	***	[1.3937, 2.1889]
Greece	0.1942	0.2246	0.86	0.387		[−0.2462, 0.6345]
Poland	−0.7396	0.2202	−3.36	0.001	***	[−1.1713, −0.3079]
Spain	0.5292	0.2115	2.50	0.012	**	[0.1146, 0.9437]
Age						
30 - 39	−0.4146	0.2042	−2.03	0.042	**	[−0.8150, −0.0143]
40 – 49	−0.2590	0.2004	−1.29	0.196		[−0.6519, 0.1339]
50 – 59	−0.2251	0.2079	−1.08	0.279		[−0.6327, 0.1825]
60 or older	0.0524	0.2142	0.24	0.807		[−0.3675, 0.4723]
Gender						
Female	0.6682	0.1274	5.25	0.000	***	[0.4185, 0.9180]
Non-binary	−0.4551	1.8617	−0.24	0.807		[−4.1049, 3.1947]
Income (in euro)						
501 - 1000	−0.0873	0.2793	−0.31	0.754		[−0.6349, 0.4602]
1001 - 2000	0.2095	0.2616	0.80	0.423		[−0.3034, 0.7225]
2001 - 4000	0.1400	0.2818	0.50	0.619		[−0.4125, 0.6925]
4001 - 7000	0.0088	0.3555	0.02	0.980		[−0.6881, 0.7058]
Above 7000	0.3207	0.4887	0.66	0.512		[−0.6375, 1.2789]
Education						
High school	−0.2230	0.3198	−0.70	0.486		[−0.8500, 0.4040]
Bachelor degree	−0.3446	0.3344	−1.03	0.303		[−1.0001, 0.3109]
Master degree	−0.7225	0.3419	−2.11	0.035	**	[−1.3928, −0.0522]
Doctoral degree	−0.3262	0.5021	−0.65	0.516		[−1.3105, 0.6581]
Sustainability Attitudes						
EcoDelivery	1.0997	0.0642	17.12	0.000	***	[0.9738, 1.2256]
StaffWell	0.6835	0.0649	10.52	0.000	***	[0.5562, 0.8109]
PreferSustainable	0.5065	0.0735	6.89	0.000	***	[0.3624, 0.6506]
SpendSustainable	0.9160	0.0738	12.42	0.000	***	[0.7714, 1.0606]
OrderNumber	0.0091	0.0210	0.43	0.665		[−0.0320, 0.0502]
Constant	5.8543	0.4543	12.89	0.000		[4.9636, 6.7450]
Mobel Statistic						
Number of Observations	4564					
R-Squared	0.3907					
F-Statistic	121.26					

Taken together, these findings reinforce the idea that sustainability messaging is most effective when it resonates with individual attitudes and beliefs. While some demographic characteristics do shape how messages are received, the clearest predictors of effectiveness are behavioural and value-based: individuals who already care about sustainability are more likely to find related messaging motivating. This highlights the importance of tailoring communication strategies not only to demographics but also to consumers' stated values and expectations.

6.3. Group variation

To deepen our understanding of how specific sustainability attitudes and demographic characteristics shape the perceived effectiveness of different message types, we investigated the interaction between message framing and our key attitudinal and demographic variables.

6.3.1 Attitudinal variables

Rather than analysing sustainability attitudes in isolation, we explored how they interact with the type of sustainability message presented. This allows us to examine whether people who strongly support certain sustainability principles respond differently to different message framings. For instance, while individuals who value eco-friendly delivery might generally be more responsive to all messages, they may find certain framings more effective, while people who score low on eco-friendly delivery might prefer different messaging. Similarly, those willing to spend more on sustainable options might show a stronger response to messages that tie sustainability to personal or symbolic impact.

To carry out this analysis, we used interaction models between each attitudinal variable and message type. This approach allows us to compare how respondents with higher versus lower sustainability orientations rate each of the five messages, holding other factors constant. By examining these interactions, we gain insight into which types of messages resonate most with certain consumers. This is useful input for informing message targeting strategies: while one type of message may perform well overall, its effectiveness can vary significantly depending on the audience's values and expectations.

This part of our analysis thus shifts the focus from average message performance to understanding how different types of consumers engage with different sustainability narratives. It helps identify where the message-person fit is strongest, and where tailoring communication could significantly enhance impact. In the graphs below, we plotted the interaction terms.

The results of the interaction analysis between message type and sustainability attitudes, shown in Figure 2, reveal a striking degree of consistency across the four attitudinal dimensions: *EcoDelivery* (Figure 2), *PreferSustainable* (Figure 3), *SpendSustainable* (Figure 4), and *StaffWell* (Figure 5). Across all four plots, individuals who report stronger agreement with each sustainability-related value, those who rated the attitudinal items as "Very motivating", consistently assign higher average motivation scores to each of the five messages. Conversely, those who are less aligned with sustainability (e.g., respondents in the "Not at all motivating" or "Slightly motivating" groups for the attitudinal items) tend to rate all messages lower, regardless of framing. This consistent pattern suggests that general sustainability orientation is a key driver of message effectiveness, regardless of how the message is framed. In other words, people who care about sustainability tend to find all messages more motivating, while those who are less engaged are uniformly less receptive, regardless of whether the message highlights route efficiency, CO_2 savings, or symbolic comparisons like trees saved.

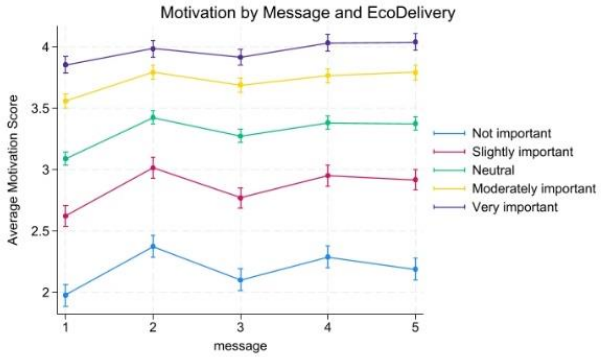

Figure 2: Motivational power of the message by preference for eco-delivery

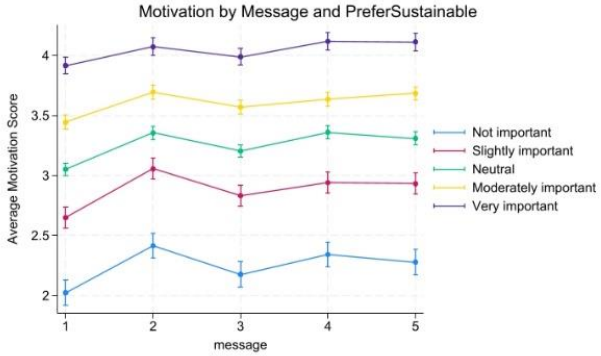

Figure 3: Motivational power of the message by preference for sustainable products

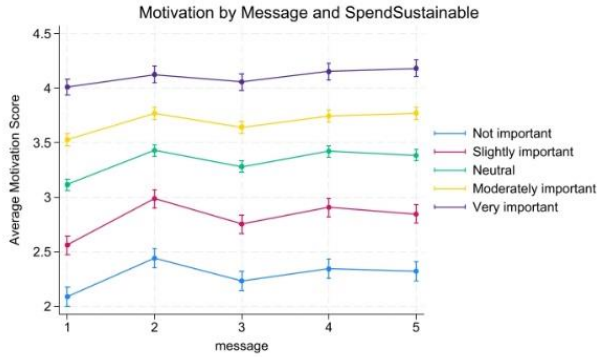

Figure 4: Motivational power of the message by willingness to spend more on sustainable products

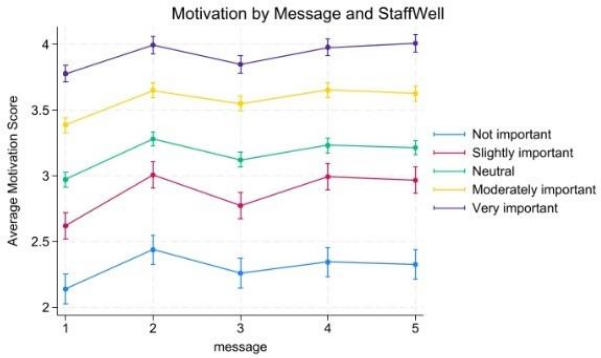

Figure 5: Motivational power of message importance of treating staff well

Although the overall shape and spacing of the curves are similar across the four attitudes, there are subtle differences worth noting. For example, in all cases, Message 2 tends to score slightly higher than the others, even among respondents with lower sustainability motivation. This message may tap into a more practical or intuitive logic that resonates more broadly, beyond strong environmental concern. Likewise, while all message types benefit from higher attitudinal alignment, Message 1 (which presents a simple CO_2 reduction percentage) consistently receives the lowest ratings across all attitude levels. This reinforces earlier findings that abstract or technical framings may be less effective, even for sustainability-oriented individuals.

An interesting pattern that emerges from the interaction plots is the difference in variation across attitudinal groups. Specifically, among respondents who scored low on sustainability attitudes, those who selected the lowest response categories, such as "Not at all motivating" or "Slightly motivating", we observe greater variation in how they rate the different message types. Their motivation levels fluctuate more noticeably across the five messages, suggesting that for less sustainability-oriented individuals, message framing plays a more important role in shaping how motivating they find a sustainability message. In contrast, among respondents who rated these attitudes at the highest level (typically "Very motivating"), the lines across message types are noticeably flatter. This indicates that once someone holds a strong sustainability orientation, all messages tend to resonate equally well. Their average motivation scores are high across the board, and the specific way a message is framed has relatively little additional influence. In other words, for these individuals, the content or nuance of the message matters less; they are simply more responsive to sustainability cues in general.

This pattern suggests that tailoring message framing may be most critical for reaching those who are not already strongly engaged with sustainability. For highly engaged individuals, the choice of framing makes less of a difference, as they are broadly receptive to the core message regardless of how it is communicated. For less engaged audiences, however, strategic framing may be necessary to capture attention and increase motivation, making message design an especially important tool for broadening appeal.

6.3.2. Demographic variables

To complement the attitudinal interaction analysis, we also examined how key demographic variables influence the effectiveness of different sustainability messages. Specifically, we explored whether the perceived motivational value of each message type varies by gender, age, country, education, and income. This analysis allows us to assess whether certain types of messages resonate more with specific population groups, and whether tailoring messages along these lines could enhance impact.

Using mixed-effects models, we interacted each demographic variable with message type. This approach captures within-person variation in message ratings while accounting for between-person differences through random intercepts. For example, in the case of gender, we tested whether men and women evaluate the same message differently. Similarly, in the case of age or education, we explored whether younger respondents or those with higher levels of formal education tend to respond more positively to certain framings, such as messages emphasising air quality, symbolic comparisons, or route efficiency. This demographic interaction analysis complements the earlier attitudinal results by offering a broader perspective on how individual characteristics shape the reception of sustainability messages. Together, these findings

contribute to a more nuanced understanding of message effectiveness and provide a basis for evidence-based communication design in sustainable e-commerce.

6.3.2.1. Gender

The interaction results between message type and gender (Figure 6) reveal a consistent pattern: female respondents report higher motivation scores across all five sustainability messages compared to male respondents. This gender gap is evident throughout the graph, with women consistently rating each message as more motivating than men, suggesting that female consumers may generally be more receptive to sustainability-related messaging.

While the overall ranking of messages is similar for both genders, Message 2 ("we are already in your street") appears most effective, and Message 3 ("kilometres saved") is rated lower, the motivational gap between men and women is relatively stable across messages. This consistency suggests that gender influences the overall level of receptiveness to sustainability messages, rather than sensitivity to a particular framing. For practitioners, this suggests that while sustainability messaging is broadly relevant, tailoring content or reinforcement strategies may be especially valuable for increasing engagement among male consumers, who appear to be less strongly motivated by the current framings. Future messaging strategies could consider using alternative framings or additional motivational hooks (such as social norms, financial benefits, or personal relevance) to better engage less responsive demographic groups.

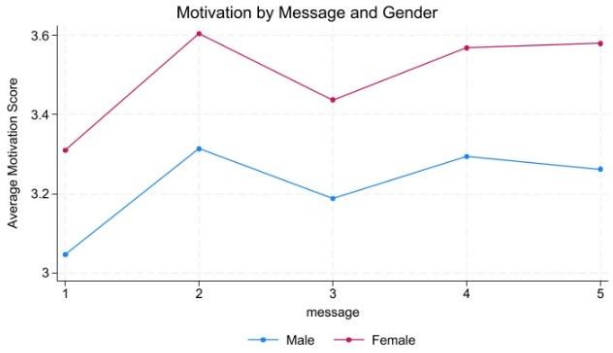

Figure 6: Motivational power of the message by Gender

6.3.2.2. Age

The interaction between message type and age (Figure 7) shows that younger respondents, particularly those in the 18 to 29 age group, tend to rate sustainability messages as more motivating than older age groups. This is especially noticeable for Message 2, which refers to delivery efficiency by stating that the courier is already in the customer's street. Younger participants rated this message significantly higher than all other age groups, suggesting it resonates more strongly with younger consumers, possibly because of its practical framing or its alignment with efficiency-oriented thinking. Across the remaining messages, however, the differences between age groups are relatively small. All age groups show the same general ranking of message effectiveness, with Message 2 performing best and Message 1, which frames emissions savings in percentages, scoring much lower. This consistent pattern indicates that although the average motivation scores vary somewhat by age, the relative appeal of the different message types remains broadly similar.

One subtle trend worth noting is that the oldest age group, 60 and older, consistently rates the messages slightly higher than middle-aged groups, suggesting that environmental messaging may also hold stronger appeal among older consumers. However, the 18 to 29 group stands out overall as the most responsive segment, both in absolute scores and in how they differentiate between message types.

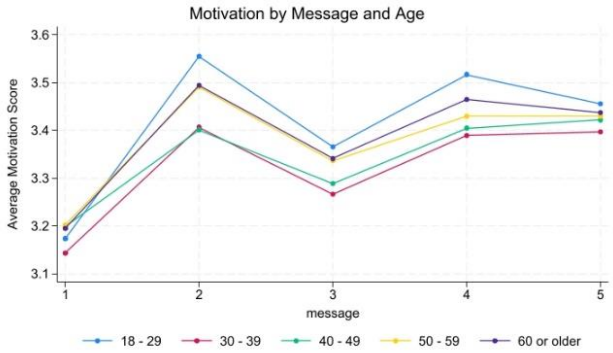

Figure 7: Motivational power of the message by Age

6.3.2.3. Country

The interaction between message type and country (Figure 8) reveals some clear and consistent differences in how motivating sustainability messages are perceived across the five countries studied. While the general ranking of messages is largely similar, Message 2 continues to stand out as the most motivating in nearly every country, the absolute levels of motivation differ significantly.

French respondents report the highest average motivation scores across all messages. This is especially visible for Message 2, which receives a particularly strong response. In contrast, Polish respondents consistently rate the messages as least motivating, with scores lower than those of other countries across all message types. This suggests lower baseline receptiveness to sustainability messaging in Poland, or possibly a different perception of its relevance or credibility. Austria, Greece, and Spain fall somewhere in between. Their motivation scores are relatively close to one another, and their trajectories across message types follow a similar pattern, peaking at Message 2, dipping slightly for Message 3, and levelling off or slightly increasing for Messages 4 and 5. Importantly, while Message 2 is the top-rated message in every country, the relative difference between messages is smaller in countries with lower average scores, like Poland and Austria. This could imply that in those countries, the variation in message framing matters less, possibly because the overall interest in sustainable delivery is lower.

Overall, these results suggest that while certain message types are broadly effective, there is meaningful variation in how strongly different national audiences respond. This highlights the value of tailoring sustainability communication to local contexts and preferences. France stands out as a highly responsive market, while Poland may require alternative messaging strategies or additional awareness-building efforts.

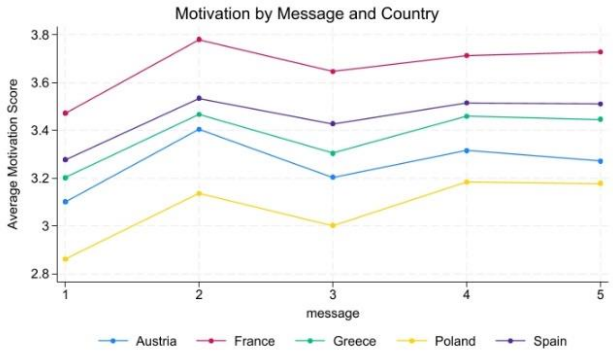

Figure 8: Motivational power of the message by Country

6.3.2.4. Education

The relationship between education level and message effectiveness (Figure 9) reveals interesting patterns in how individuals respond to different types of sustainability messaging. Overall, those with higher levels of education tend to rate the messages as more motivating, though the variation is not entirely linear. Respondents with a doctoral degree consistently rate the messages highest, with a particularly strong response to Message 2, which again emerges as the most effective across all educational groups. Their average motivation scores remain elevated across all five messages, suggesting a broad and sustained receptivity to sustainability messaging among the most highly educated.

In contrast, those with a master's degree report the lowest motivation scores overall. This dip is somewhat unexpected and may reflect either differences in values or greater scepticism toward messaging strategies. Still, their response follows the same general pattern, with Message 2 rated highest and Message 3 lower. The middle education categories, bachelor's and high school degrees, fall between the two extremes, with bachelor's degree holders showing particularly strong engagement, especially for Messages 4 and 5. Respondents with no formal education also report moderate to high motivation, particularly for Messages 2 and 4.

Taken together, these findings indicate that while education may influence how strongly individuals respond to sustainability messaging, the relative appeal of different message framings is broadly shared across educational levels. This suggests that well-crafted messages can be effective across diverse segments of the population, although some tailoring may still enhance resonance among specific groups.

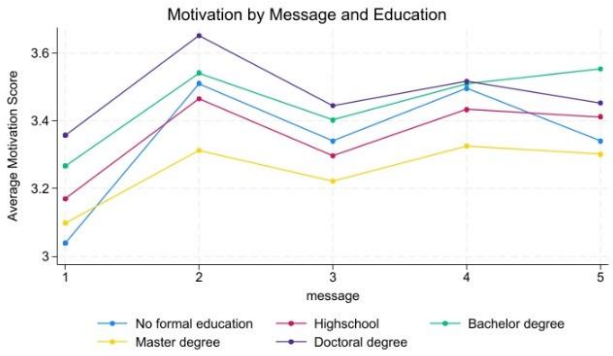

Figure 9: Motivational power of the message by Education

6.3.2.5. Income

The interaction between message type and income group (Figure 9) reveals a clear gradient in motivation: individuals with higher incomes consistently rate the sustainability messages as more motivating than those with lower incomes. This trend is particularly pronounced among respondents earning more than 7,000 euros per month, who report the highest motivation scores across all five message types. Their ratings peak with Message 3 and remain elevated even for the lower-ranked messages, indicating a generally high receptiveness to sustainability messaging. This is especially interesting given that Message 3 refers to kilometres not driven. Higher-income individuals may drive more frequently or own multiple vehicles, making this message more personally relevant. In this sense, the framing could resonate more because it links sustainability benefits directly to their daily mobility patterns.

Conversely, individuals in the lowest income bracket (below 500 euros) consistently report the lowest motivation scores. This suggests that the framing of sustainability messaging may resonate differently depending on economic context. Individuals with greater financial security may be more receptive to environmental appeals, possibly because they perceive more freedom to act on such motivations or because sustainable behaviour aligns with other values associated with their lifestyle. These findings highlight the importance of considering economic segmentation when designing and targeting sustainability communication. While some messages may appeal broadly, others may need to be adapted or combined with financial incentives to be equally persuasive across different income groups.

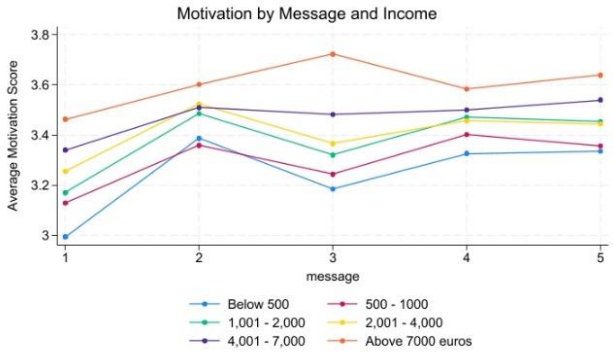

Figure 9: Motivational power of the message by Education

7. Conclusion

This deliverable has explored how sustainability-related information can be communicated in ways that are transparent, credible, and motivating for consumers. Drawing on literature, industry practice, stakeholder insights, and survey-based experiments, we identified both the barriers to effective sustainability communication and the conditions under which consumers are more likely to engage. Our findings point to the importance of combining tangible, emotionally resonant messages with a clear presentation of ecological or social impact. Rather than relying solely on data or technical terms, effective communication should make environmental benefits relatable and show consumers how their choices contribute to broader outcomes.

These insights provide a foundation for future work within the GreenTurn project. They directly inform the co-design and prototyping activities of WP4 and serve as input to T6.1 and T6.2, which focus on testing and evaluating real-world applications. By understanding what types of messages are more likely to motivate sustainable delivery choices, this deliverable supports the development of communication strategies that are not only more effective but also more aligned with consumer expectations and the sector's broader sustainability goals.

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Appendices

Appendix A: Search Strings

Appendix A.1: Initial search string

TITLE-ABS-KEY-AUTH ("last mile options" OR deliver* OR fulfillment OR "shopping situations" OR "urban freight distribution") AND TITLE-ABS-KEY-AUTH (sustainab* OR "Carbon Footprint" OR "environmental impact") AND ABS ("shoppers" OR consumer* OR customer*) AND ABS (choice OR choose OR willing OR decision OR decide OR option) AND ABS (informat* OR attribute OR nudg* OR incentiv* OR motivat*) AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND NOT ABS (food) AND NOT ABS (health)

Appendix A.2: Final search string

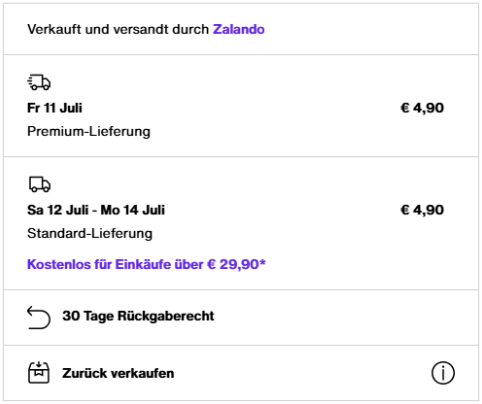
TITLE-ABS-KEY-AUTH ("last mile options" OR deliver* OR fulfillment OR "shopping situations" OR "urban freight distribution") AND TITLE-ABS-KEY-AUTH (sustainab* OR "Carbon Footprint" OR "environmentalimpact") AND ABS ("shoppers" OR consumer* OR customer*) AND ABS (choice OR choose OR willing OR decision OR decide OR option) AND ABS (informat* OR attribute OR nudg* OR incentiv* OR label OR motivat* OR option) AND PUBYEAR > 2015 AND PUBYEAR < 2026 AND (LIMIT-TO (EXACTSRCTITLE , "Cleaner And Responsible Consumption") OR LIMIT-TO (EXACTSRCTITLE , "Transportation Research Part D Transport And Environment") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Logistics Management") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Physical Distribution And Logistics Management") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Retail And Distribution Management") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Sustainable Transportation") OR LIMIT-TO (EXACTSRCTITLE , "International Journal Of Transport Economics") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Business Logistics") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Cleaner Production") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Retailing And Consumer Services") OR LIMIT-TO (EXACTSRCTITLE , "Logistics") OR LIMIT-TO (EXACTSRCTITLE , "Production And Operations Management") OR LIMIT-TO (EXACTSRCTITLE , "Research In Transportation Business And Management") OR LIMIT-TO (EXACTSRCTITLE , "Research In Transportation Economics") OR LIMIT-TO (EXACTSRCTITLE , "Sustainable Production And Consumption") OR LIMIT-TO (EXACTSRCTITLE , "Transportation Research Record"))

Appendix B: Screenshots Checkouts

Austria

Amazon

Zalando



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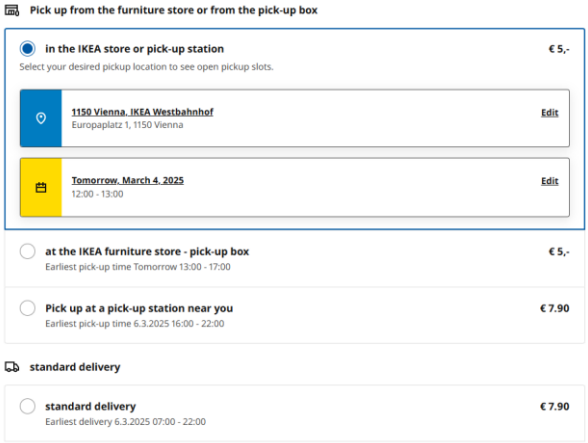
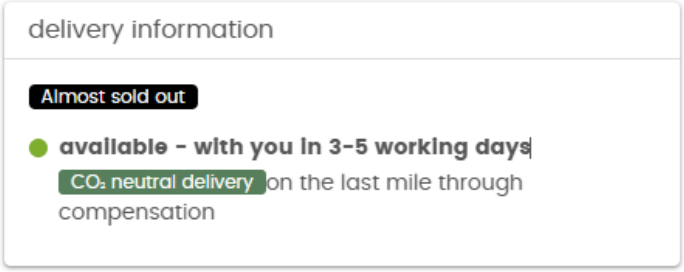


Universal



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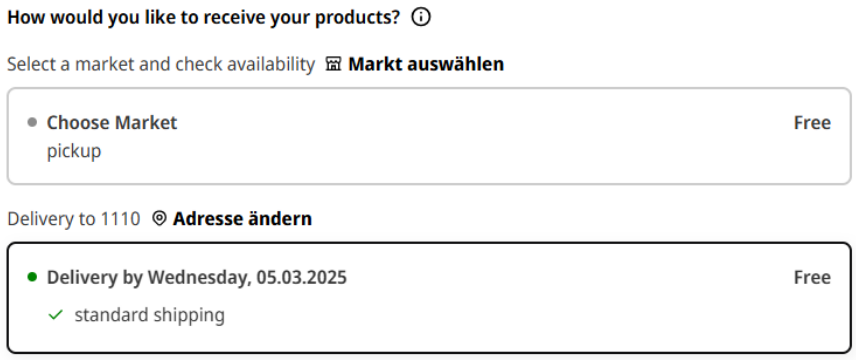
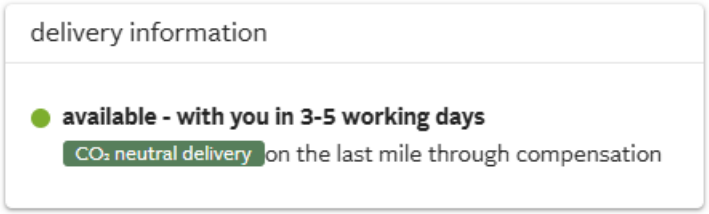
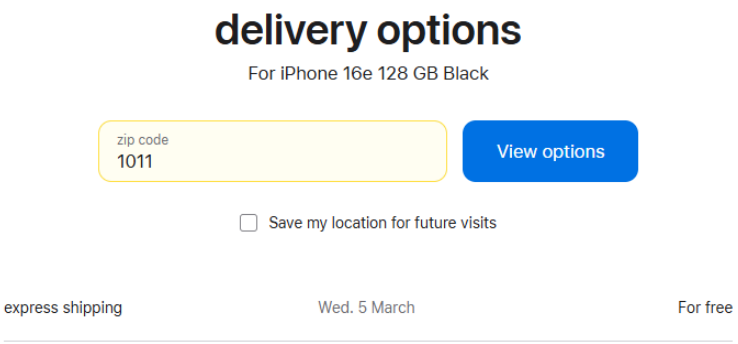


Otto

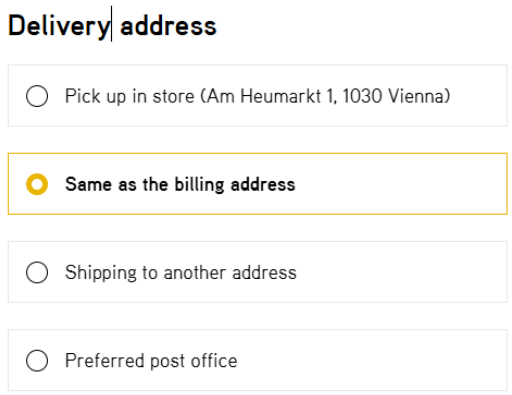


Apple

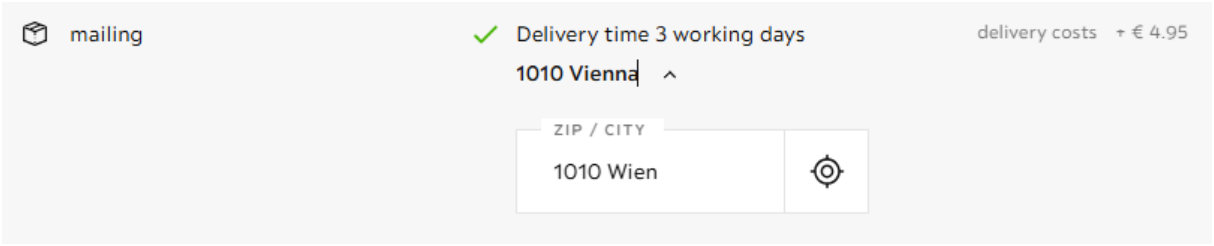


BestSecret: Cannot make a screenshot

Münze Österreich

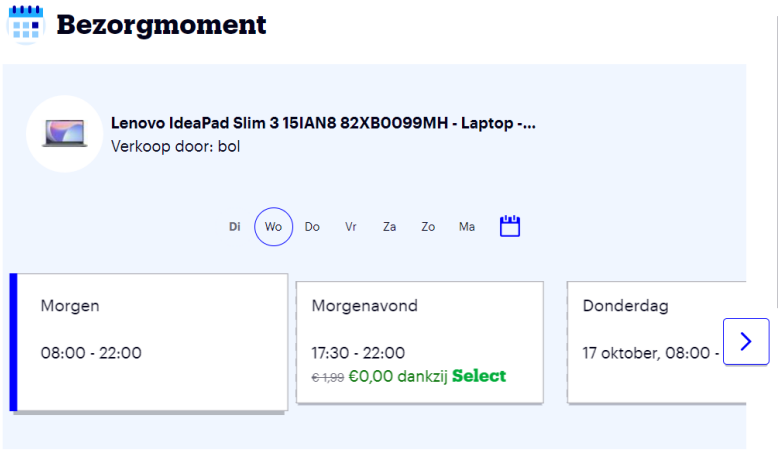


XXXLutz

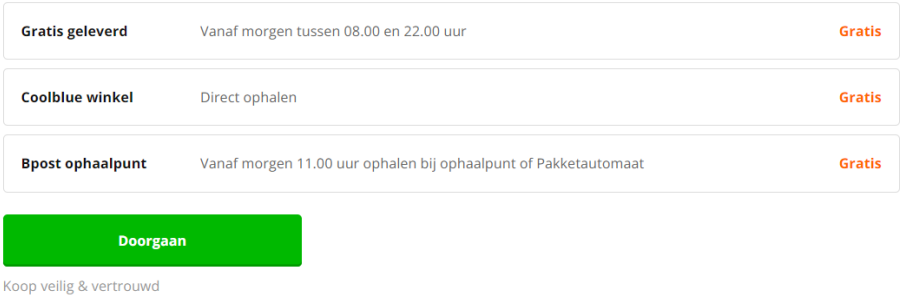


Belgium

Bol.com

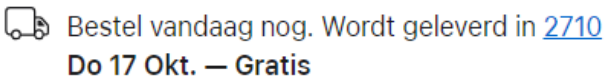


Coolblue



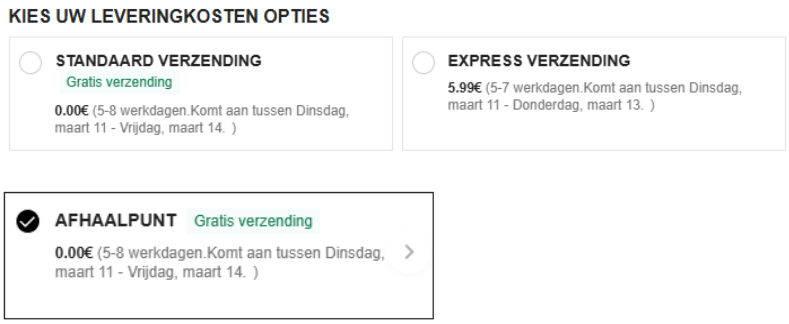
Zalando

Apple



Amazon

Shein



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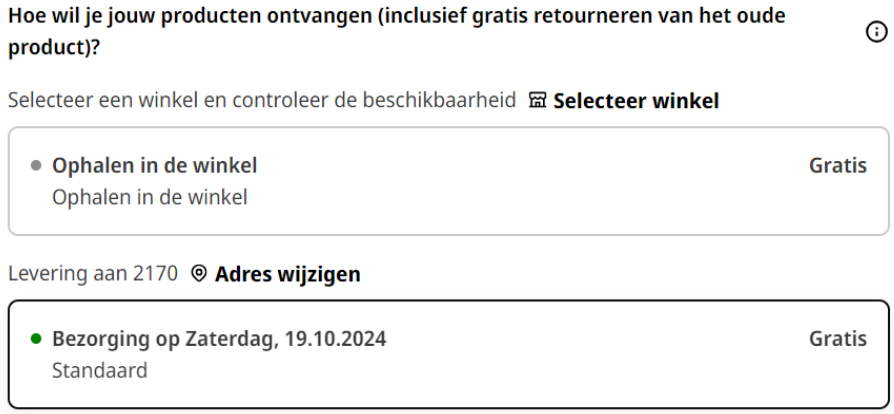
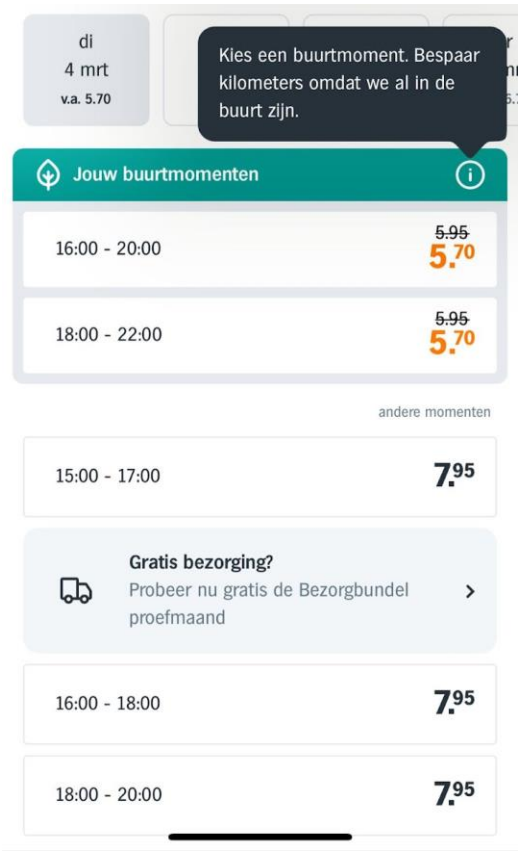


Ikea

Delhaize

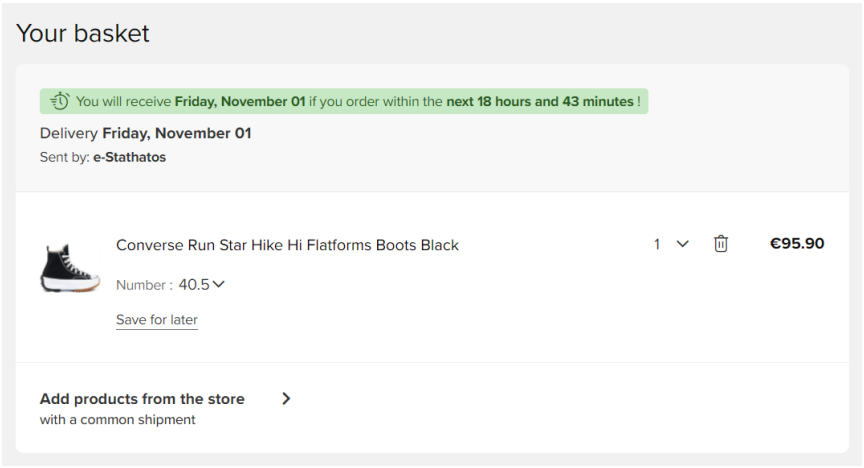
Funded by the European Union

Albert Heijn



Greece

Skroutz



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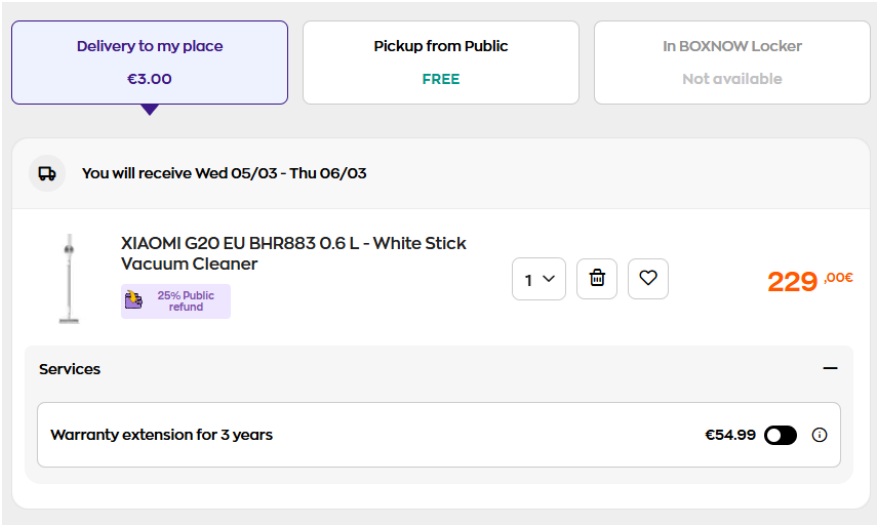
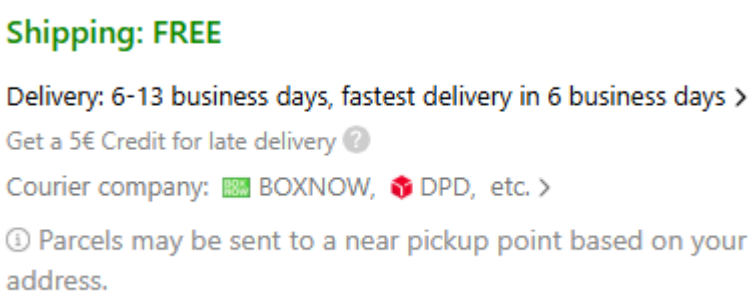
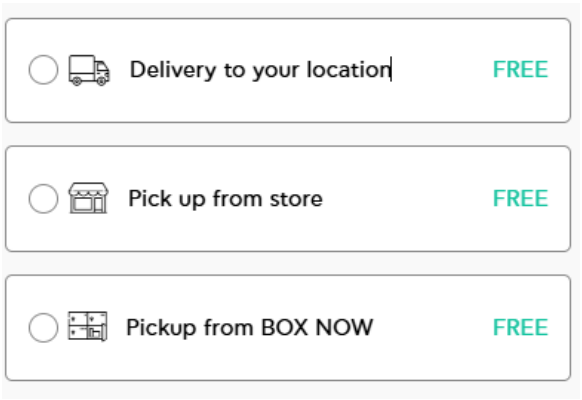


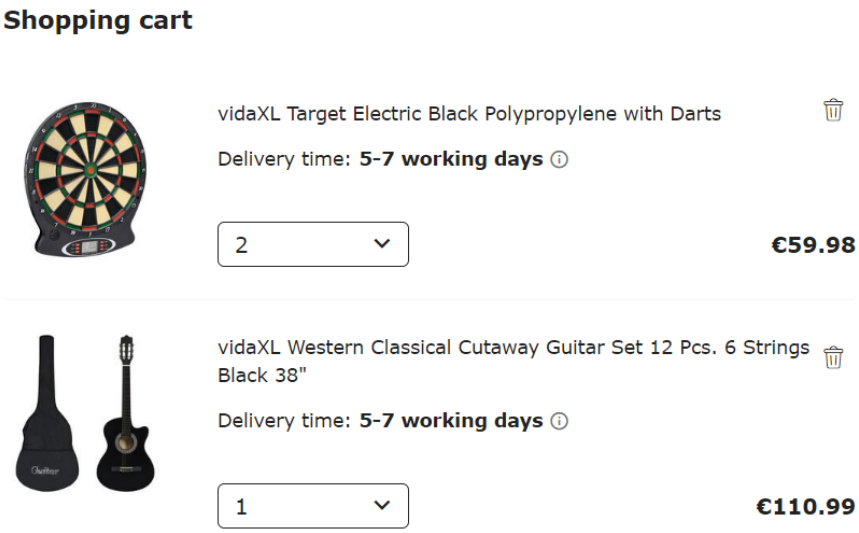
Temu



Plaiso



VidaXL



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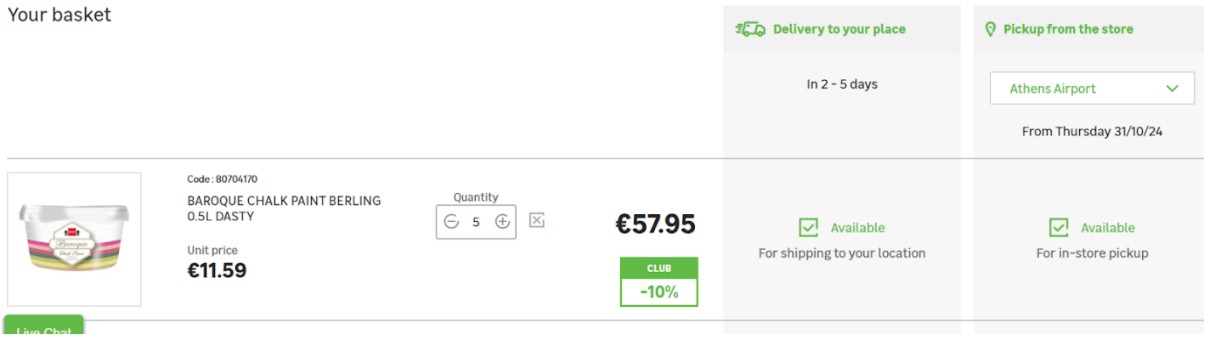

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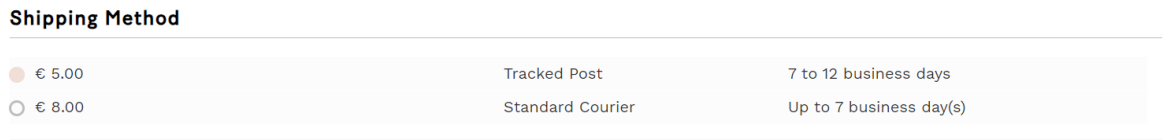
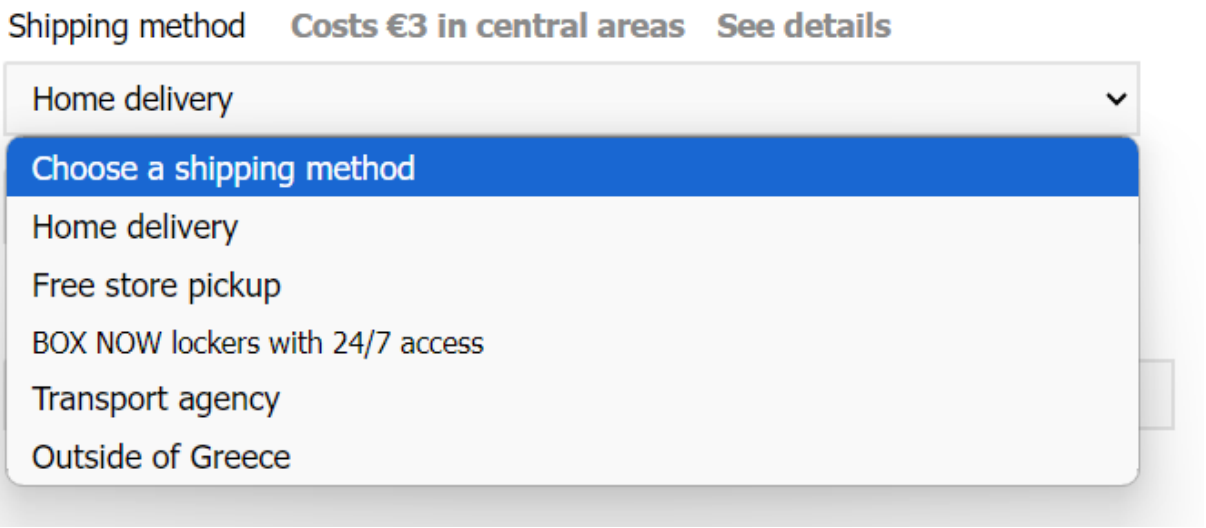
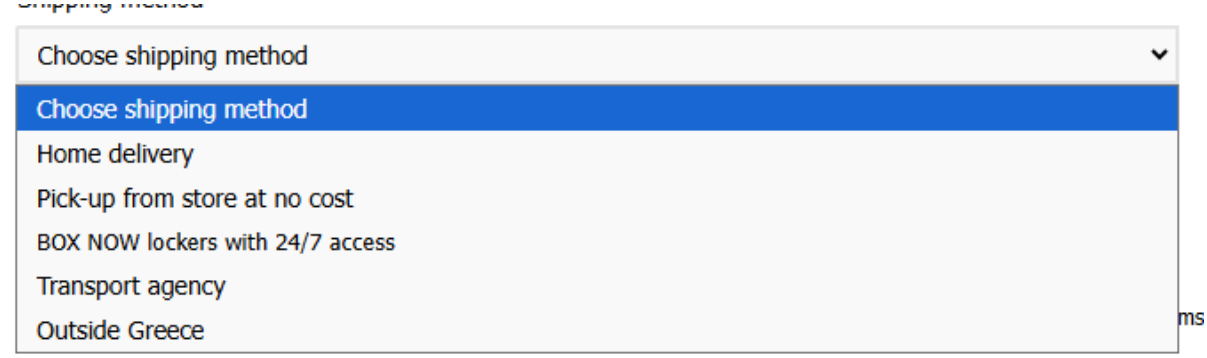


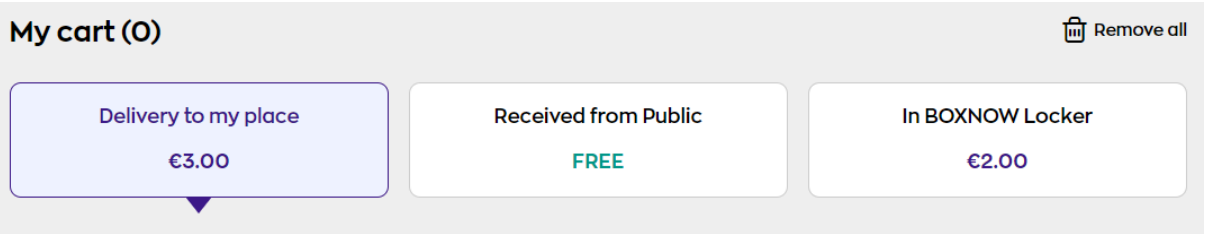


E-shop



BestPrice: This is a comparison website so no delivery options

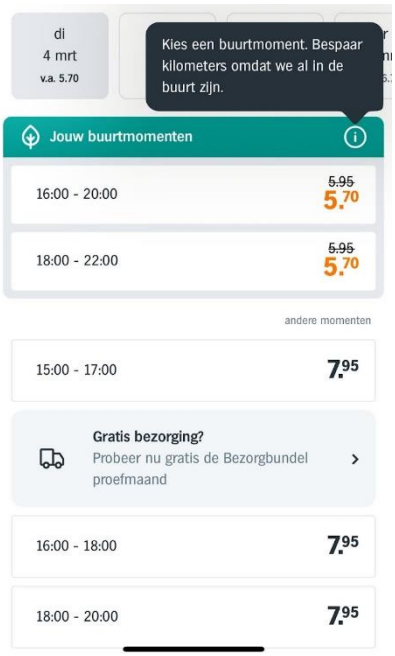
Media Markt



The Netherlands

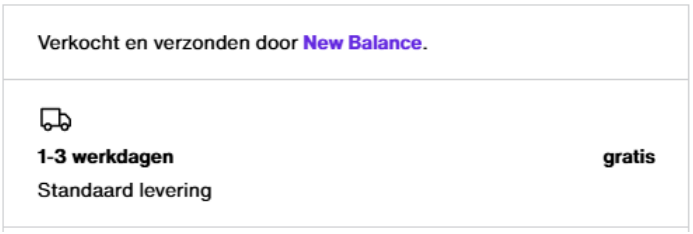
Bol.com

Albert Heijn



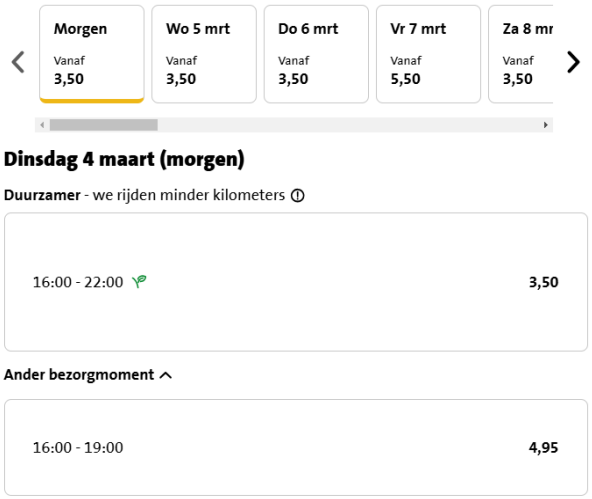
Coolblue

Zalando



Amazon

Jumbo



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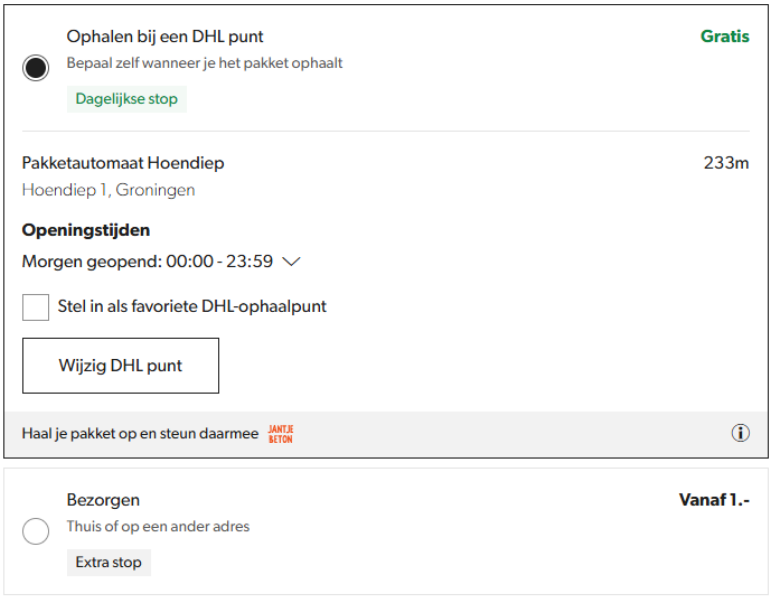
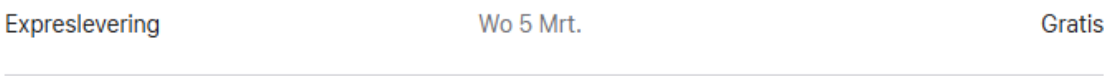


Picnic

Apple



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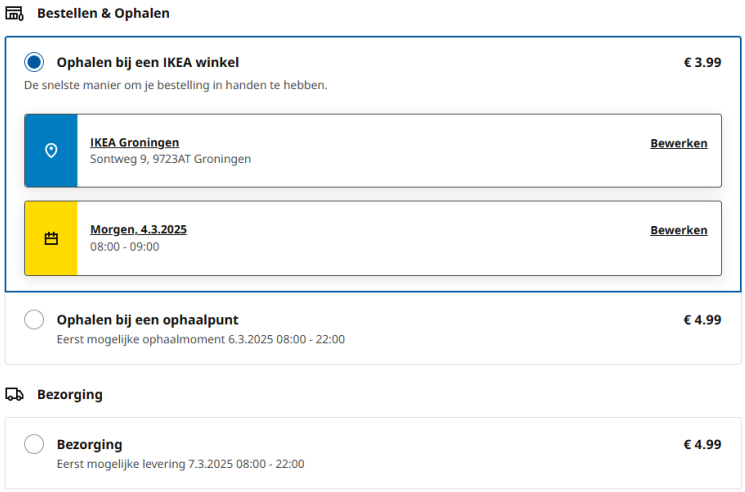
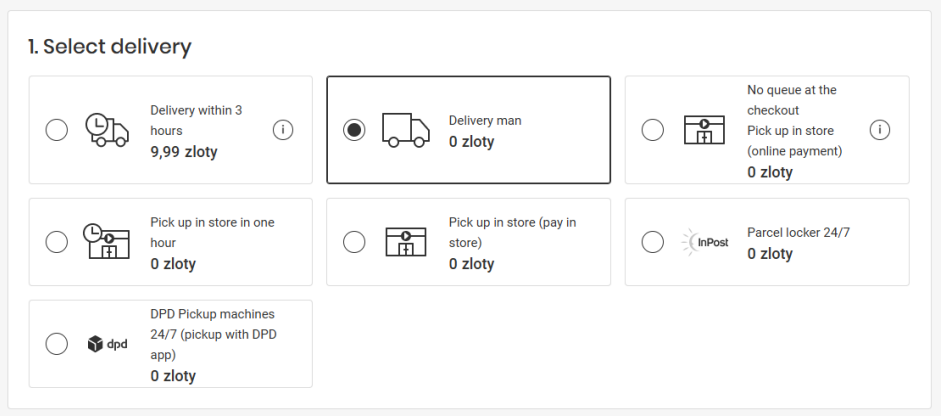
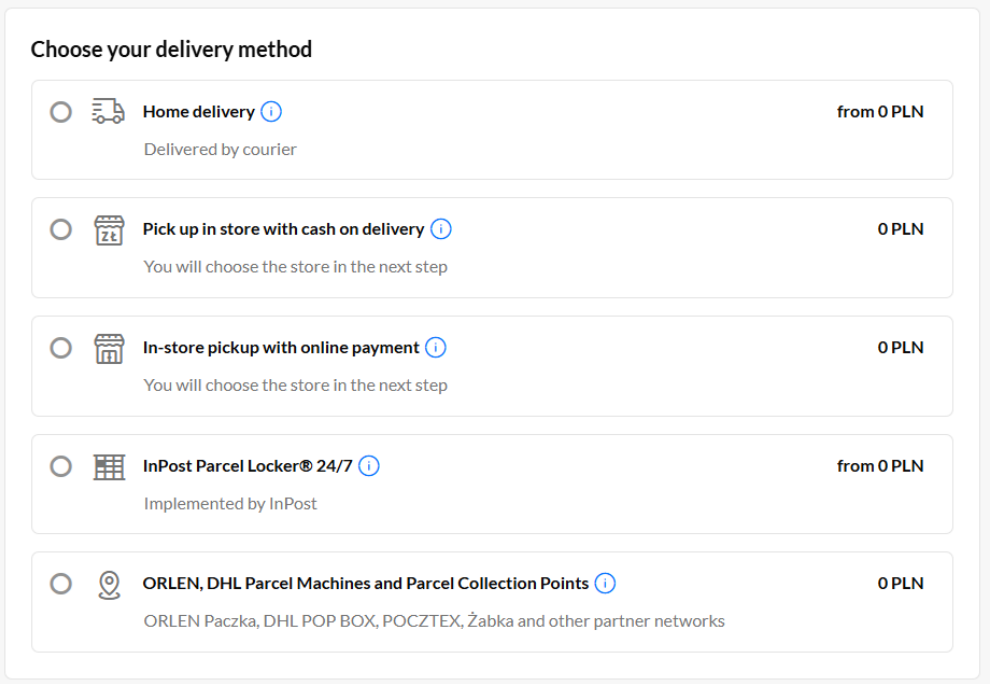


Poland

Mediaexpert



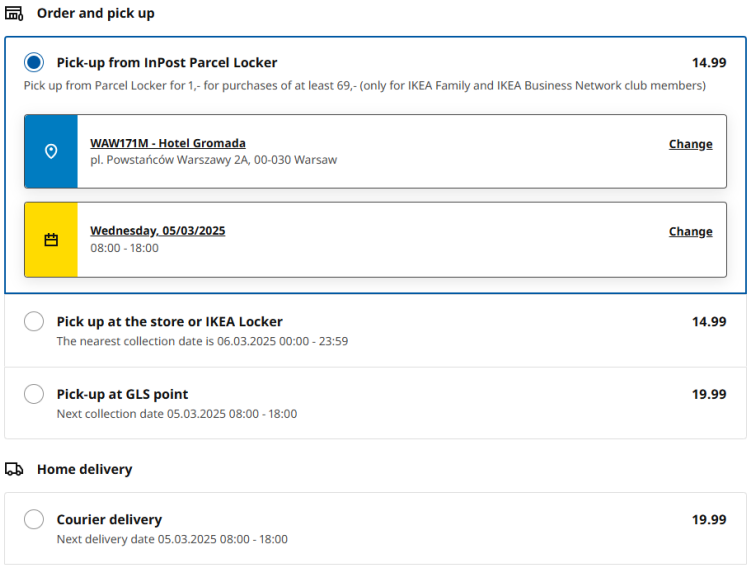
Euro.com



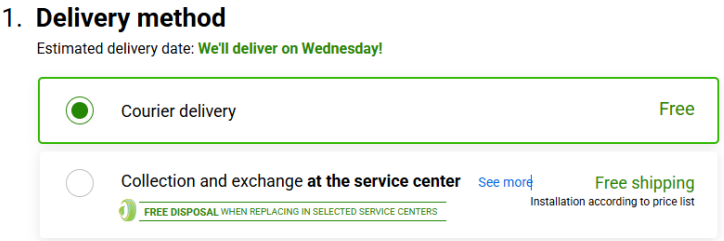
Zalando

Amazon

Ikea



Oponeo



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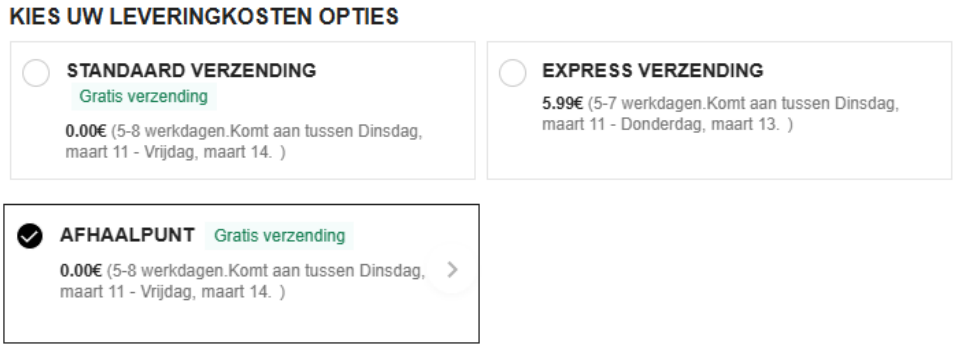
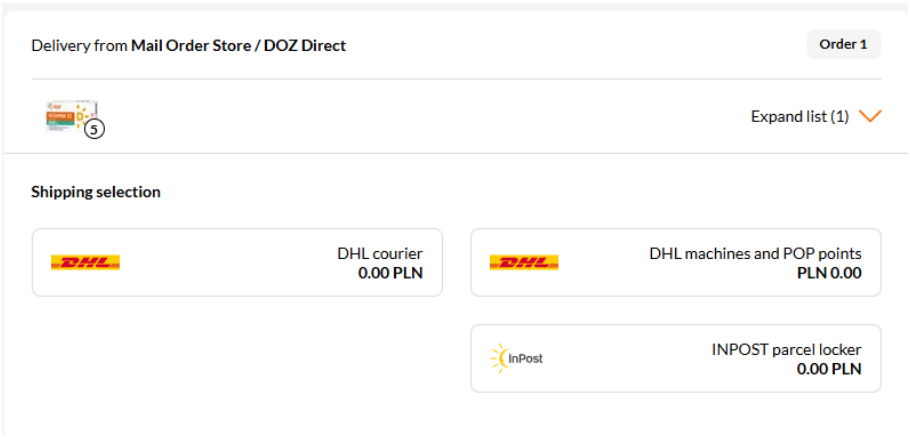


Doz



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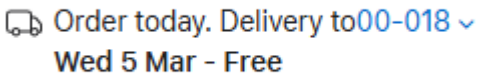
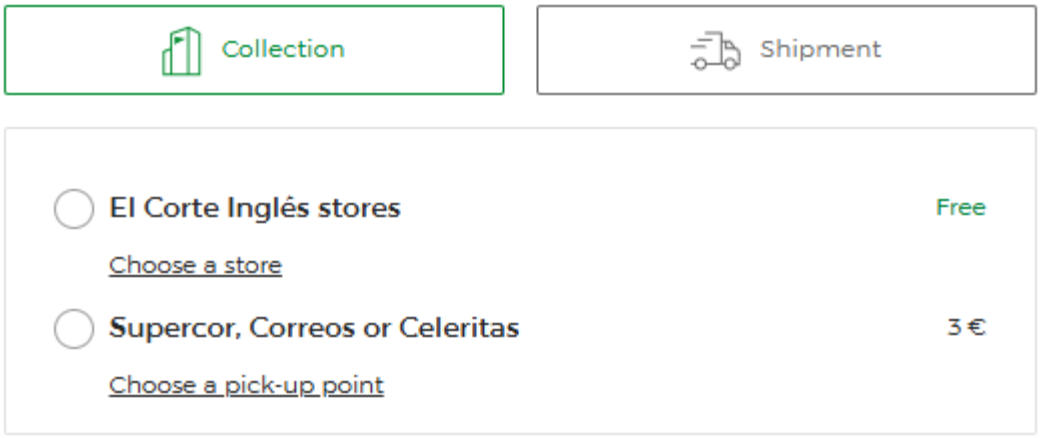


Zalando-lounge

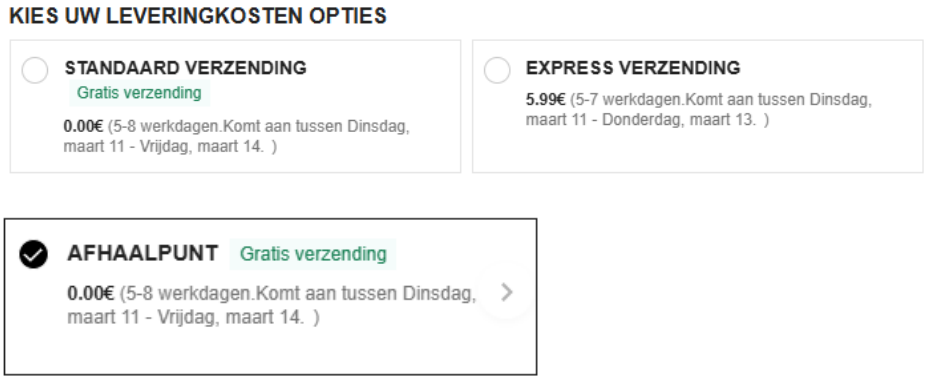
Spain

Amazon

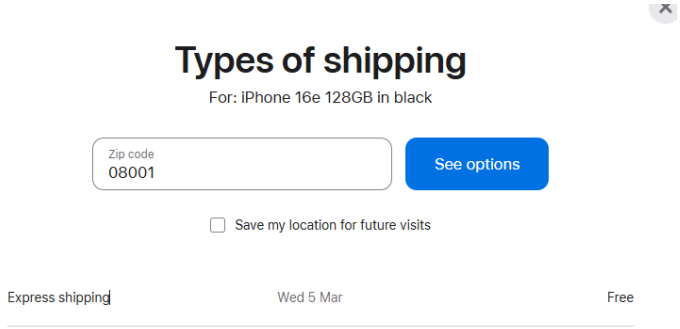
El Corte Inglés



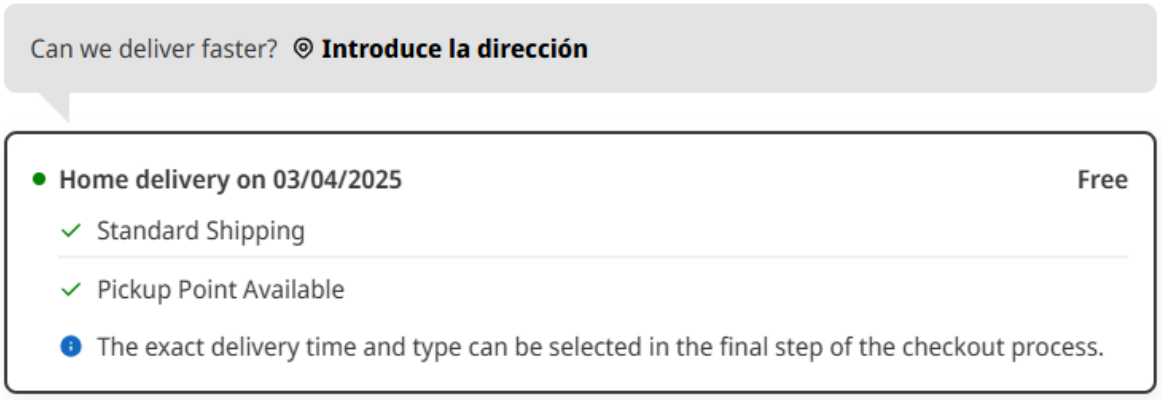
Shein



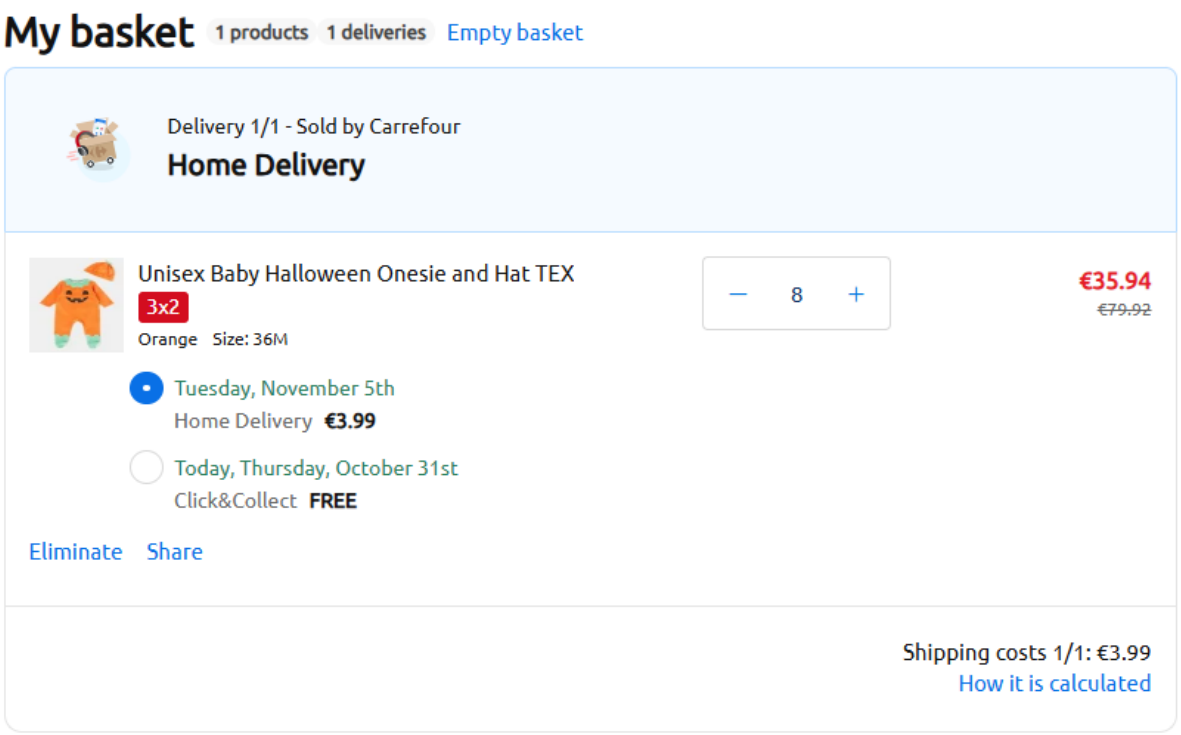
Apple



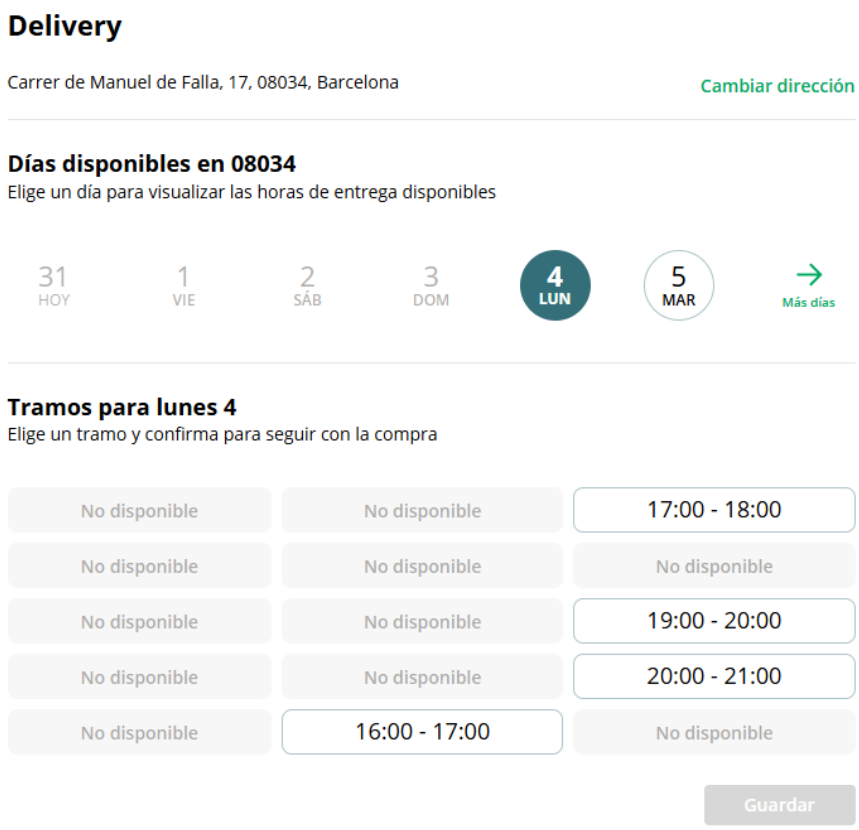
MediaMarkt



Carrefour



Mercadona



Zalando

Zara

PcComponentes

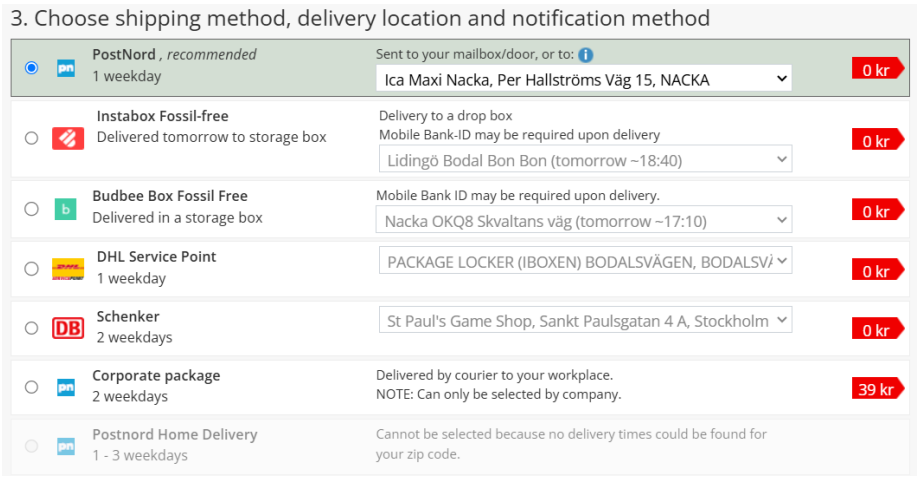
AMD Ryzen 5 5600X 3.7GHz

134.90 € ~~376 €~~

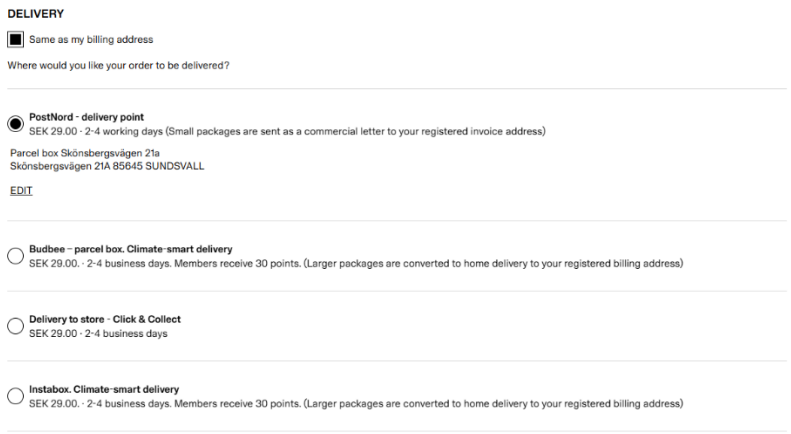
Receive it on Monday, November 4th

Sweden

Apotea



H&M



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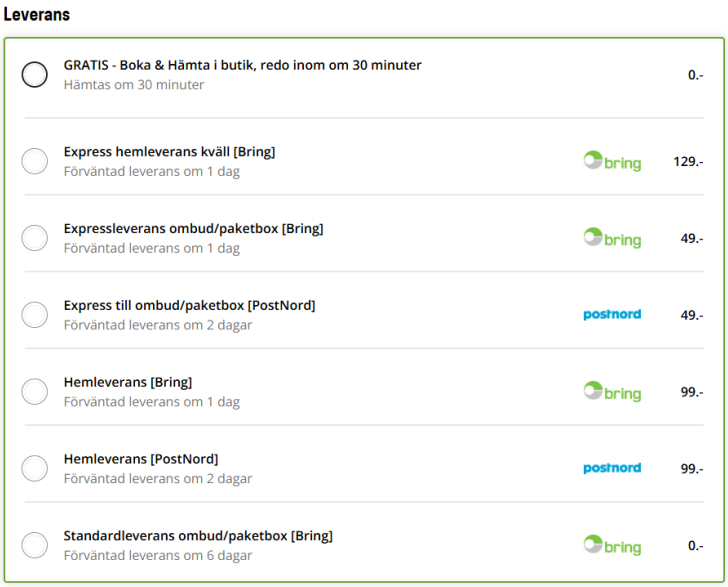
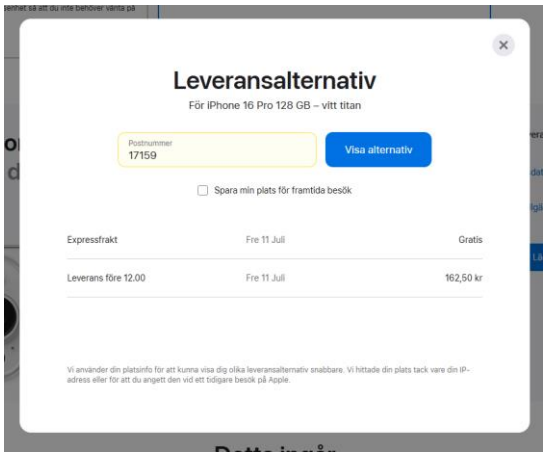
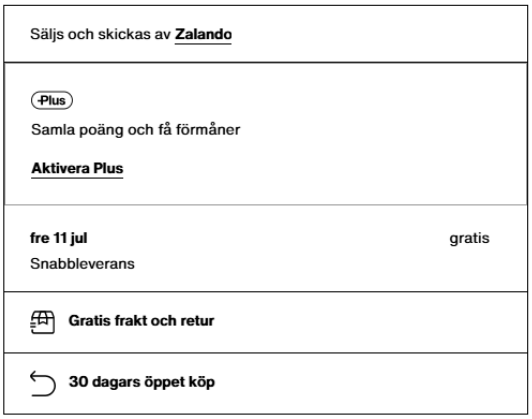


Apple



Zalando



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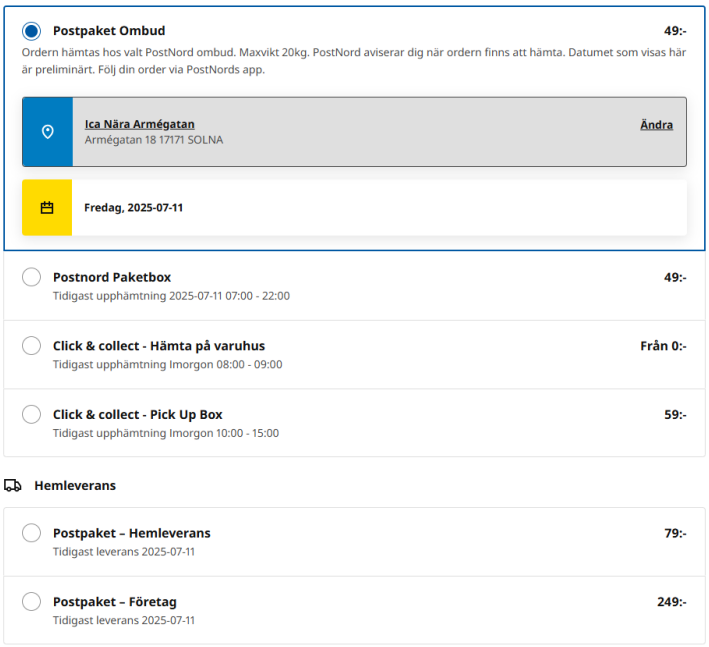
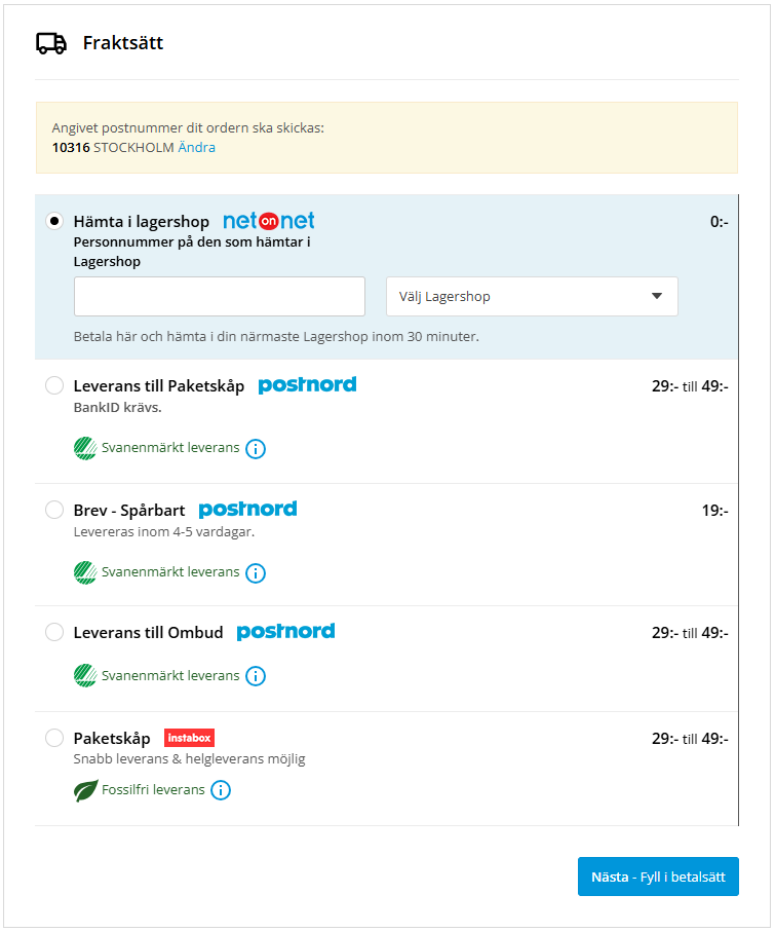
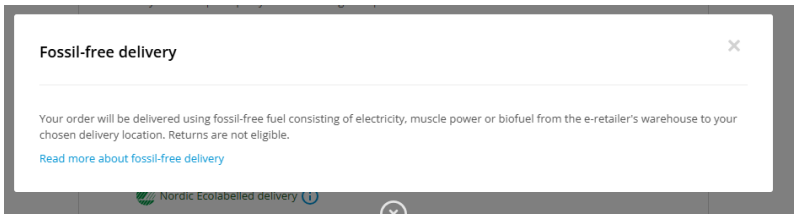
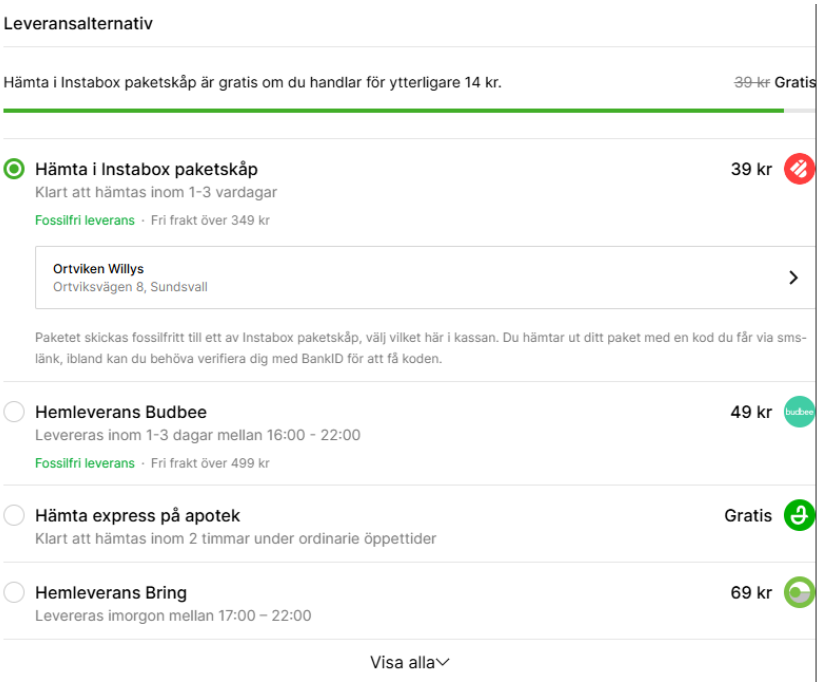


Net on Net

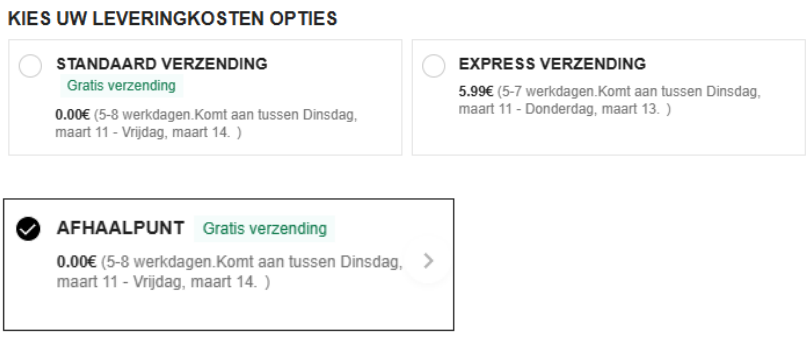




Apoteket



Shein



Mathem