Mapping of the digital climate nudges in Nordic online grocery stores

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ABSTRACT

This paper explores how 21 Nordic online food retailers nudge their customers towards more climate-friendly food choices. We use a choice architecture taxonomy dividing the nudges into decision information, decision structure, and decision assistance. We find that most retailers use several types of climate nudges. Most of these are decision information type nudges, such as personalized carbon footprint apps and climate labels. Wide use of non-salient nudges, often presenting the climate impact after the customers have made their purchase, limits the potential impact of information on consumers' environmental footprints. Furthermore, the use of broad climate categories and aggregated CO_2 measures reflect the challenges in calculating the footprints of individual products. The lack of industry-wide standards for emission data and climate labels makes the current situation challenging for customers wanting to compare emissions across stores. Our results also show that few stores have any form of decision structure or decision assistance nudges, even though these are often found to be the most effective types in the literature on nudges. We end with discussing promising digital climate nudging opportunities for retailers seeking to reduce the environmental footprint of their customers.

1. Introduction

Among the most prominent trends shaping food markets are the increase in online sales and the growing concerns about the food system's sustainability (Blondin et al., 2022; Mitzner, 2022). Online retailers have broadly adopted personalization and persuasive practices to influence their customers' purchases. This gives them an excellent opportunity to influence the sustainability of food demand (European Commission, 2022). Through choice architecture and digital nudges, online retailers can target specific consumers with tailored information or nudges at the moment of decision-making, opening up a new realm of possibilities in behavioral interventions. As emissions data and availability of life cycle analyses (LCA) for different foods are improving, the potential for retailers to provide personalized feedback to consumers about the environmental effects of their food consumption increases. These developments are reflected in an increasing number of digital tools at online grocery stores, which aim to influence customers to buy more climate-friendly food. In this paper, we map out the landscape of digital climate nudging in Nordic online grocery stores and discuss their potential impact on behavior and consumers' climate footprints.

Many food product attributes are relevant to a consumer, and features such as price, taste, quality, and convenience are generally rated more important than environmental impact (Hoek et al., 2021). Furthermore, since retail shopping occurs in an information-overloaded environment where many decisions are made in short time spans, all information about the product and the alternatives cannot be processed and perfectly balanced against each other. Consumers will therefore simplify decisions by relying on heuristics and habits, using rules of thumb to ease the cognitive load in decision-making (Grunert, 2011; Weinmann et al., 2016). This is especially the case for food consumption, which happens frequently and often involves many products (Johnson et al., 2012). The habits and heuristics we base our food decisions on are also formed by cognitive factors such as knowledge, skills, attitudes, and personal identity, and sociocultural factors such as cultural norms and values (Chen and Antonelli, 2020). These factors can act as barriers to dietary changes and explain the attitude-behavior gap in sustainable consumption (Bishop et al., 2022).

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Retailers report their greenhouse gas (GHG) emissions according to Scopes 1, 2, and 3 (GHG protocol, n.d.). Scope 1 is the direct emissions from own or controlled sources (e.g., their vehicles), while Scope 2 is the indirect emissions from purchased energy (e.g., emissions from producing the electricity for the warehouses). Scope 3 emissions include all the remaining emissions the retailer is indirectly responsible for, up and down its value chain. More than 90 % of food retailers' total emissions are Scope 3 (Bartosz et al., 2022). Despite this, the environmental component of the sustainability programs of prominent food retailers has tended to concentrate on the emissions they can directly control rather than reducing the impact of the products they sell (Tatum, 2021). However, among the largest Nordic retailers, there seems to be an awareness of Scope 3 emissions. For instance, Sweden's largest retailer Ica, Denmark's largest retailer, Coop, and Norway's largest online retailer Oda have set numerical targets for the environmental footprints of their customers. Several retailers also describe some implemented measures to decrease customers' footprints (Coop amba, 2022; Icagruppen, 2022; Kesko, 2022; Oda, 2022).

By taking on these Scope 3 emissions, food retailers can play an essential role in mitigating climate change. The food sector contributes to 28 % of households' carbon footprint, making it households' dominant emission sector (IPCC, 2022). Production of animal-based food emits considerably more greenhouse gases and requires more land than plant-based food (Ranganathan et al., 2016). Production-side measures alone are insufficient to address the environmental problems' severity, and demand-side measures are critical for limiting warming to 1.5–2C (Bajželj et al., 2014; Clark et al., 2020). Encouraging a dietary shift from animal products (especially ruminant meat) to a plant-rich diet is considered one of the most effective food-related measures in climate change mitigation. Since traditional economic measures like carbon pricing disproportionately burden poorer individuals, the report points to non-economic measures such as labeling and nudges for achieving dietary changes (IPCC, 2022). One of the most impactful steps food retailers can take is thus to promote climate-friendly diets.

The food shopping landscape is changing quickly, and there is a lack of up-dated studies providing examples of climate interventions in online food retailing. For instance, in a review of carbon labeling from 2016 with implementation examples from a few years back, there are no examples from digital platforms (Liu et al., 2016). Instead, they have examples of printed labels on physical products, like Tesco's carbon label, which was halted in 2012 (Vaughan, 2012). Outdated reviews are not very helpful to online retailers and other stakeholders attempting to get an overview of the sustainability measures implemented in the market today and the effect these may have on the industry's environmental goals. Moreover, remaining data challenges and multiple ways to calculate and present footprints make comparing footprints across products challenging. Retailers are still in the early stages of figuring out how best to use and communicate these data to consumers effectively to influence consumers.

We contribute to the literature by mapping out the landscape of climate functionalities and features in Nordic online grocery stores as of September 2022. We provide an updated overview of implemented digital nudges attempting to influence consumers to buy climate-friendly food. Based on the existing evidence from the literature on behavioral interventions to promote sustainable consumption, we discuss some factors limiting the impact of these climate features on consumers' environmental footprints. Finally, based on the mapping and the following discussion, we sketch out some nudging opportunities for retailers seeking to reduce the environmental footprint of their customers.

2. Literature review

To understand the potential of digital nudges for climate-friendly food consumption, it is necessary to comprehend the mechanisms underlying them and how they play out in digital food retail.

2.1. The potential of digital nudging for dietary changes

Online retailers are choice architects that design the decision environment in which their customers make choices. The term *nudge* refers to interventions in the decision environment that can alter people's behavior without restricting options or significantly changing economic incentives. These interventions aim to steer behavior by anticipating and integrating people's limitations on decision-making, such as bounded rationality (Thaler et al., 2010). Since nudging as a behavioral change technique relies on automatic cognitive processes or heuristics, it can be a promising technique for inducing dietary changes (Oliver, 2013). Habits drive food choices, and choice architecture can target the environmental cues that trigger these automated habits and replace them with cues that promote the desired options (Verplanken and Wood, 2006; Wood and Rünger, 2016). As a result, Mertens et al. (2022), in their meta-analysis of choice architecture interventions across behavioral domains, highlight food choices as a responsive domain for choice architecture.

The increased use of digital technologies means that people make more and more decisions in digital environments such as websites or mobile apps (Mirsch et al., 2017). With the emergence of online food retailers, this is not less true for food decisions. *Digital nudging* has been defined as "the use of user-interface elements to guide people's behavior in digital choice environments" (Weinmann et al., 2016, p. 1). Nudging can be particularly effective in settings such as online stores, as eliminating many sensory appeals allows for more tailored choice architecture (De Bauw et al., 2022; Mirsch et al., 2017). Information systems also allow faster and cheaper implementation of nudges and updating or changing information compared to an offline setting (Mirsch et al., 2017), giving online retailers a comparative advantage over physical ones regarding nudging.

Although dietary changes are hard to bring about, many new digital platforms have already gained traction by changing and replacing existing food shopping routines (Samsioe and Fuentes, 2022). Extraordinary incidents like COVID-19, which break repetition, can create good conditions for fostering new, more sustainable, long-term eating patterns (White et al., 2019). Now that many customers are trying online food shopping for the first time, this disruption of existing food shopping habits presents an opportunity for change.

2.2. Taxonomy of nudging techniques and its theoretical and empirical anchoring

In much of the existing reviews on nudging interventions, categorization of the nudges is done in an ad-hoc manner, without using a pre-defined taxonomy. However, with the growing literature on choice architecture interventions, several taxonomies for categorizing and systematizing these interventions have been proposed. Among them is the framework for developing effective choice architecture interventions developed by Münscher et al. (2016). This taxonomy builds on *the behavior change wheel*, a much-cited model for characterizing and designing behavior change interventions (Michie et al., 2011). The advantage of this taxonomy is that it is made inductively from documented cases of nudges, and the focus on intervention techniques facilitates the development of new testable interventions. Furthermore, its overlap with the computer science concept of *persuasive technology* makes it accessible for digital user experience designers and computer scientists (Fogg, 2002). Given its advantages, the taxonomy of Münscher et al. has become a widely adopted framework in recent reviews on the effects of nudges (Jesse and Jannach, 2021; Mertens et al., 2022; Wyse et al., 2021). As a result, this taxonomy will serve as a starting point for our mapping of climate nudges.

Münscher et al. propose three basic categories of interventions, or *choice architecture techniques*: 1) Decision information, 2) Decision

structure, and 3) Decision assistance, reflecting different streams in the decision-making literature.

2.2.1. Promoting sustainable consumption by decision information nudges

Information about the climate effects of food is not easily attainable to the average consumer, so people might lack the knowledge to make climate-friendly choices. Consumers generally perform quite poorly when knowledge about the climate effects of food is tested (Austgulen et al., 2018; Camilleri et al., 2019). Information on climate impact can be complicated and challenging to digest and must be presented to consumers in a way that is interesting and understandable to them. This finding is in line with translation theory, an approach to studying and understanding the processes of communicating sustainability features in a useful and meaningful way to consumers (Viciunaite, 2020). An example of this is standardizing the different GHG emissions from food production in CO_2 equivalents (CO_2e), which compares the warming effect of various gases over a fixed timescale. Using this standard measure facilitates comparisons of climate effects across different food products.

However, consumers can also find it hard to relate to the term CO_2e. Therefore, climate footprint information on food is often presented as a label with colors or symbols that tell the consumer whether a product has a relatively high or low impact (Liu et al., 2016). Further simplifications of emission data can relate emission numbers to an activity the customers are more accustomed to thinking about as polluting, such as the distance traveled with a fossil fuel vehicle (White et al., 2019). Other ways of reducing information overload by increasing relevance are personalizing emission information or providing social reference points. Social reference points can also influence behavior by reducing uncertainty, appealing to people's need for approval, and maintaining a positive self-concept (Cialdini and Goldstein, 2004). Since norms and traditions are important drivers of food choices, providing a social reference point can be a suitable type of decision information in food shopping (Chen and Antonelli, 2020; Vatn et al., 2022).

Moreover, the climate impact attribute of a food product might not be top-of-mind in the shopping context. If a consumer has a positive but not very strong attitude towards sustainable consumption, the attitude might be dormant and less accessible in their memory. Thus, it might not play a role in decision-making (Grunert, 2011). If consumer attention to climate impact is engaged at the decision point, they will have the opportunity to pause and reflect on their values before they opt for either a high-emission or a low-emission food product (Attwood et al., 2020). This highlights the importance of timely information targeting, where emission feedback is provided to customers when browsing products.

However, the effect of providing emissions information on sustainable consumption is contested. Although several reviews indicate that providing environmental information about food consumption can have statistically significant effects, there is a lack of experimental evidence, and most of the literature relies on self-reporting (Blondin et al., 2022; Grundy et al., 2021; Hoek et al., 2021). Some reviews on the effects of sustainability information on actual consumer behavior have reported significant, albeit small effects on the consumption of sustainable food (Blondin et al., 2022; Harguess et al., 2020; Potter et al., 2021), while others fail to find significant effects (Nisa et al., 2019). On the other hand, a lack of knowledge about the environmental effects of food seems to be a particularly large problem for making climate-friendly food choices. Compared to other attributes, such as health, consumers appear to be less able to compare products and product types in terms of environmental impact (Hoek et al., 2021).

Furthermore, the literature indicates that there are more and less effective ways of nudging with information. As much of the information on and around a product is ignored (or at least not consciously perceived), the saliency of the information will affect the perception and processing of it. The climate information must attract visual attention

in the information-overloaded grocery shopping context (Taufique et al., 2022). Since sustainability attributes are not necessarily top-of-mind when consumers shop for food, the *timing* of the information nudge is also crucial for success (Attwood et al., 2020). Timing should also be coordinated with information on attributes other than climate. Climate nudging has been found to be most effective in later stages throughout the food purchasing process if products are presented with information on both nutrition and environmental impact, possibly because nutritional attributes are more important drivers for food choices (De Bauw et al., 2022).

In the taxonomy of Münscher et al. (2016), decision information consists of interventions altering the presentation of the available information. The category is divided into *translating information*, *making information visible*, and *providing a social reference point*. *Translating information* refers to reframing or simplifying the information so that it is understandable and makes sense in the receiver's context. *Making information visible* is making external, unavailable information available or giving feedback on own behavior. *Providing a social reference point* refers to cues about socially appropriate behavior.

2.2.2. Promoting sustainable consumption by decision structure nudges

Options are more likely to be chosen if the efforts required are low. Even marginal changes have been shown to matter more than standard economic theory would predict (Münscher et al., 2016). Decision structure interventions have been shown in the reviewed literature as the most effective in changing behavior out of the three across behavioral domains. This is deemed to be because they offer cognitive shortcuts and thus require less processing and alignment of values and goals (Mertens et al., 2022).

Because food shopping is habitual and often almost automated, simplifying the decision process can help consumers form more sustainable habits. For example, vegetarian dishes are more likely to be ordered at restaurants when menus are rearranged in their favor (Gravert and Kurz, 2021). Recommendation agents are also extensively used in e-commerce to reduce the choice environment's complexity (De Bauw et al., 2022). Another way of reducing the efforts needed to choose a sustainable option is by making it the default, which has been shown to work to stimulate electricity efficiency (White et al., 2019). Changing the social consequences by making purchasing choices public has also been shown to increase the desire for green products (Griskevicius et al., 2010).

Münscher et al. (2016) refer to decision structure interventions as "the arrangement of options and decision-making format". They divide the category into *changing choice defaults*, *changing option-related effort*, *changing the range or composition of options*, and *changing option consequences*. *Changing choice defaults* is making the option preferred by the choice architect pre-selected. *Changing option-related efforts* refer to marginal changes in the effort required to select an option. *Changing the range or composition of options* is based on the finding that the attractiveness of an option is relative and depends on the alternatives presented. *Changing option consequences*, also referred to by Münscher et al. as "micro incentives", are changes in financial or social consequences of options that are insignificant from a rational choice perspective but still have been found to affect choices.

2.2.3. Promoting sustainable consumption by decision assistance nudges

A lack of self-control might prevent people from acting in line with their intentions. Committing to acting a certain way, either to oneself or publicly, can help bridge the intention-behavior gap by playing on the cognitive dissonance that arises when goals and actions are inconsistent (White et al., 2019). Another explanation for why people don't always behave according to their intentions is that attention is limited. Reminders can make climate implications of choices more salient and thus increase commitment attainment (Karlan et al., 2016).

A main challenge for nudging sustainable food consumption has been stabilizing the change and seeing long-run effects (Samsioe and Fuentes, 2022). For instance, tools with personalized feedback on environmental footprint of food consumption have been found effective for reducing emissions, but the impact fades quickly with engagement (Fosgaard et al., 2021). New habits can be formed when people pursue goals by repeating the same responses in a given context. Another way goals integrate with habits is through the explanations people generate for them. People tend to infer strong, consistent underlying motivations and goals from their repeated behaviors (Wood and Rünger, 2016). Commitment-based interventions have been used successfully to encourage sustainable consumption of energy and household products (Abrahamse et al., 2007; Becker, 1978; Bodur et al., 2015). Goal setting has specifically been found to reduce the environmental footprints of consumers in simulated online grocery shopping settings (Kanay et al., 2021).

In their taxonomy, Münscher et al. (2016) refer to decision assistance as helping people follow through with their intentions. They divide this into *providing reminders* and *facilitating commitment*. *Providing reminders* heightens the salience of the desired option. *Facilitating commitment* refers to giving people the possibility to make private or public commitments towards certain behaviors.

3. Materials and methods

3.1. Applying the taxonomy of choice architecture techniques

An essential step in the framework of Münscher et al. (2016) involves scoping out what types of behavior change approaches are applicable and possible in the relevant behavioral context. Most practitioners are faced with limitations as to what interventions are practically feasible. We will facilitate this step of retailers' development process of green digital nudges by applying the taxonomy to map out the implemented interventions present in the Nordic market as of September 2022. The systematic outline of available techniques will also help identify gaps and unused potential for future interventions.

The behavioral interventions are mapped by content analysis of the digital platforms. Specifically, we use a combination of examination of the actors' digital platforms and reviewing press releases, annual reports, or other published, publicly available information from the platforms about their features. The mapping is explorative, intending to uncover what behavioral interventions are in place in the Nordic online grocery markets. We focus on the specific actions the interfaces encourage and how the relevant functionalities and features were designed and framed to appeal to and reward the user. The lead author identified potential nudges and discussed their placement in the taxonomy in detail with the other economist in the author team. We have also contacted the retailers with our results, as a fact-check to make sure we did not miss any relevant nudges.

3.2. Scope of the mapping

This paper concentrates on the Nordic countries; Norway, Sweden, Denmark, Finland, and Iceland. Nordic consumers are among the early adopters of online food retail. Relative to the EU average of 10 %, quite a high proportion of people in the Nordics had purchased food online in 2021, from 13 % in Finland to 22 % in Denmark and Sweden. From 2020 to 2021, these numbers increased by 12–60 % in the Nordics (Eurostat, 2022). These trends have led to high valuations of online food companies, and several new actors have been established in the Nordic online food market over the past couple of years (Ummelas, 2021). The covid-19 pandemic accelerated this development, with the "forced adoption" of online grocery services allowing new companies to grow and attract

investment in this space (Bradshaw and Lee, 2021). The Nordic countries are also similar in terms of socioeconomic indicators and political system, which means that they can be comparable in terms of consumer opportunities to engage in sustainable, online food shopping.

The main selection criteria for the actors included in the mapping is that they are grocery stores with digital platforms and home delivery. Some might also have physical stores, while others only have warehouses, which are used for picking and shipping products to customers. The included stores have a selection of products that cover most household grocery needs. This excludes specialized stores that only offer a narrow range of products, like locally grown produce. It also excludes meal box companies and surplus grocery stores like havaristen.no or matsmart.se, which are limited to products that other grocery stores cannot or will not sell for various reasons. Finally, we do not include the rapid grocery actors that have gained momentum during the covid-19 pandemic and are rising in the Nordic countries. Although these actors may earn a substantial part of the market if the business model succeeds, they are still relatively small and in a start-up phase. Based on a quick investigation into the online stores of Foodora, Kavall and Vembla, these actors are focusing on gaining traction in the market rather than sustainability at this point. Small, independent actors who deliver in a very limited area or only offer their products on third-party platforms are also not covered. Overall, the selected companies cover most of the online grocery market in the Nordics as of September 2022.

The digital retailers investigated in our mapping are Oda, Meny/Spar/Joker (with common loyalty program Trumf) in Norway, Mathem, mat.se, Ica, Coop, Hemköp, and Willys in Sweden, K-Citymarket, Oda and Prisma in Finland, Nemlig, Coop, Føtex, Aarstiderne and BilkaToGo in Denmark, and heimkaup, Krónan and Netto in Iceland. The Swedish actors Mathem and mat.se merged in June 2022, which was during our mapping period. From then on, mat.se's customers are redirected to the Mathem platform. However, we have chosen to keep mat.se separate in our mapping since they had more digital climate nudging tools than Mathem did and currently has.

The target behavior in this study is climate-friendly food consumption. Interventions are therefore relevant when they target Scope 3 emissions by encouraging actions related to climate-friendly *diet choices*. This excludes other food-related environmental measures like reducing food waste. It also excludes promoting locally produced food unless it is linked to environmental concerns (which it usually is not). Furthermore, we concentrate on measures taken by the retailer. For instance, climate labels on individual products implemented by the producer, and included as product information at the retailer, are not included. Landing pages on a retailer's website where the general climate impact of food consumption is presented also do not fall under our definition of a digital nudge. This is information that the customer must actively look for, and it is similar to the other information on this topic available on other internet sites. Since we rely on public online information to find the relevant interventions, there could be some that we have not been able to include here. This could, for example, be if a user must have an active account to be subjected to the measure, and the implementation has not been promoted or mentioned in the company's public statements. We contacted all companies, presented discovered nudges, and asked for additional suggestions, but none reported interventions within our study's scope.

3.3. Food climate footprint data

The actors who enable customers to track the climate impact of their food consumption, and present products with a climate score, have necessarily mapped the products they sell to emission data. Actors in the

food value chain do not provide standardized life cycle assessment (LCA) data, making it challenging to produce and maintain exact product emission databases. As an alternative, Nordic retailers use licensed databases provided by suppliers like RISE (Norway, Sweden), CONCITO (Denmark), and Luke (Finland). These databases are based on the most relevant available LCA studies with emissions presented in CO_2e for individual food products. Retailers need to know the quality and comparability of this data when evaluating how to use it in their sustainability work.

Databases presenting LCA-derived emission data for different types of foods often show different emissions for the same kind of food. As an example, the Danish CONCITO database reports Atlantic salmon as having a footprint of 9.11 CO2e/kg, whereas this number is 6.1 in the Swedish RISE database (CONCITO, 2021; RISE, 2022). This is despite the fact that both these countries consume mostly Norwegian salmon and both are neighboring countries to Norway, which means that the real difference in footprint should be minimal (resourcetrade.earth, 2020). These types of differences can have several reasons, including 1) the use of different boundaries, i.e. how much of the value chain is included in assessing a product's emissions, 2) which elements within the value chain are included or excluded, 3) differences in allocation of emissions across multiple products (e.g. milk and meat), 4) differences in emissions between farms and different production methods, 5) differences in how studies convert gases such as methane to CO_2 equivalents, and 6) if emissions are calculated per kg product, per energy content or other units. Depending on the level of aggregation in a database, the emissions allocated to a product in a database may be derived from the ratio of national production and import from different countries. Moreover, emission data represent a point in time, reflecting what a certain study found for a certain type of production, feed, energy mix, etc. in use at that time. Emissions will naturally change over time due to changes in production, energy mixes, use of different feed, trade between different countries, or even weather conditions.

While emission data can be of high quality, and no approach is right or wrong in itself, the changes in import, differences between production types and the different approaches used to estimate final product emissions will give different answers. The result is that emission data are often not comparable between products, databases, retailers, or brands, and it is important not to view product emission data as absolute and final.

4. Results

The results from mapping the digital nudge interventions to promote sustainable consumption in Nordic online grocery stores are presented in Table 1. We exclude from Table 1 the actors that, at the time of the mapping, had no tools in place. This excludes all the Icelandic actors, Willy's, Nemlig, BilkaToGo, and Rema 1000 Denmark.

Our results show that online food retailers in most Nordic countries have implemented digital nudges to promote more climate-friendly diets. There is a range regarding how many nudges the stores have, when in the customer journey they appear, and what levers they use to engage and influence customers. In this section, we present an overview of the implemented interventions and examine some of them more closely to get a picture of the current activity in the market.

An example of the nudges in place at the Norwegian retailer Oda is provided in the Appendix.

4.1. Decision information type interventions

This section will provide an overview of the observed decision information nudges. We will then give a more detailed description of how

Table 1
The presence of digital nudges to promote climate-friendly food consumption in the Nordic online food retail market as of September 2022.

A	Decision information	Online grocery stores (COUNTRY)
A1	Translating information	
	Presenting emissions in terms of CO_2e or emissions from other activities	Oda (NO), Meny/Spar/Joker (NO), mat.se[a] (SE), Mathem (SE), ICA (SE), Coop (SE), Hemköp (SE), K-Citymarket (FI), Prisma (FI), Coop (DK), Føtex (DK), Aarstiderne (DK)
	Labeling of emission categories by colors or leaves	Oda (NO), Meny/Spar/Joker (NO), ICA (SE)
A2	Making information visible	
	Personalized emission feedback	Oda (NO), Meny/Spar/Joker (NO), mat.se[a] (SE), K-Citymarket (FI), Prisma (FI), Coop (DK)
	Climate label on products	mat.se[a] (SE), Coop (SE)
	Climate label on recipes/meal kits	Oda (NO), mat.se[a] (SE), ICA (SE), Føtex (DK), Aarstiderne (DK)
	Inspiration web page with climate-friendly recipes	Oda (NO), Meny (NO), Mathem (SE), Hemköp (SE)
A3	Providing a social reference point	
	Social comparison	Meny/Spar/Joker (NO), mat.se[a] (SE), Prisma (FI), Coop (DK)
B	Decision structure	Online grocery stores (COUNTRY)
B1	Change choice defaults	Not observed
B2	Change option-related effort	
	Climate-friendly recipes category[b]	Oda (NO), mat.se[a] (SE), ICA (SE), Prisma (FI), Føtex (DK)
	Sorting products, recipes, or meal-kit on footprint	mat.se[a] (SE), ICA (SE), Aarstiderne (DK)
	Climate-friendly option banner on top of search results	mat.se[a] (SE)
	Climate-friendly switch button on recipes	Føtex (DK)
	All meal-kits are low on animal protein	Aarstiderne (DK)
B3	Change the range or composition of options	Not observed
B4	Change option consequences	
	Bonus points for choosing green products	Hemköp (SE)
C	Decision assistance	Online grocery stores (COUNTRY)
C1	Provide reminders	Not observed
C2	Facilitate commitment	
	Climate-friendly meal-kit subscription	ICA (SE), Aarstiderne (DK)
	Footprint goal-setting option	K-Citymarket (FI)

[a] The mat.se interventions are reported as of June 2022.
[b] Prisma and Coop have separate online recipe sites tied to the online grocery store, which are not included.

the retailers present emissions data to their customers. Finally, we describe the timing and saliency of these nudges.

4.1.1. Overview

All retailers who present decision information about the climate impact of food consumption *translate this information* (A1) to make it understandable for the customers. All present footprints in terms of CO_2e. Some present the footprints using a color scale from red to green or one to three green leaves. Some of them also translate information about footprints into emissions from other activities that could be more tangible or familiar to consumers, like the equivalence of km driven by a fossil-fueled car or the time a house can be powered.

We observed quite a few examples of *making information visible* (A2). All actors in Norway and Finland and one in Denmark offer

personalized feedback on carbon emissions from the customer's food purchases. These climate dashboards must often be accessed through the retailers' apps and are sometimes tied to a loyalty program. Many of the tools translate climate information. For example, one of the climate dashboards allows the customer to virtually plant a tree for every climate-friendly habit chosen in the app. Although the impact of planting a tree does not correspond to the climate impact of the habit, this is a way of making the environmental impact more tangible to the customer.

Some Nordic retailers also present emission data in the form of climate labels on products, recipes, and meal kits. These are further described in Section 4.1.2.

Several of the personalized feedback apps *provide a social reference point* (A3) for the customer to compare their footprint to others – most commonly that of the average customer, but sometimes also the country average.

4.1.2. Presenting emissions data

Among the online retailers who present emission data to the customers, there is a variation in which aggregation level the data is presented at. Some present numbers or numeric intervals, while others present the data in terms of emission categories. Former mat.se presented a unique number of CO_2e for each food product. Now that mat.se no longer exists, only Oda and Coop.se present product-level climate data to customers. These actors do not present numeric labels but operate with emission categories (low to high climate impact). For example, in Coop.se's webshop, both salmon and chicken products are presented in the medium climate impact category. Unlike mat.se's label, this presentation of emissions data does not allow for comparisons of footprints of products within the same category. Oda also presents a personalized order level footprint (per kg) in their climate dashboard functionality.

The other retailers with emissions feedback tools present the information on an even more aggregated level, at the week or month level. In these cases, it is impossible for the customers to explicitly see which products have high or low footprints and how substantial the differences are. However, the historical data is usually combined with statistics on which (wider) product categories most of the emissions of the customer come from, such as "meat, poultry and egg" and "dairy". Customers can thus deduct from this information which products have relatively low and high footprints.

Some retailers in Sweden, Norway, and Denmark also present emission data in their climate labeling of recipes. This information is, in some instances, shown as a numeric footprint per portion. More commonly, the retailers present these data in emission categories, such as defining the recipes with a footprint under a particular benchmark as climate-friendly. In some cases, the category is presented as a symbolic label. In others, it's in the form of an inspiration page with a list of recipes defined as climate-friendly.

4.1.3. Saliency and timing of the information

As for the timing of the decision information nudge, this varies somewhat. When retailers give personalized emission feedback from actual purchasing behavior, this information is provided at some point after an order has been made. The information will appear in a customer's digital profile and must be sought out actively by the customer. The only example of decision information presented on individual products to all customers in the decision situation is the carbon label of the former mat.se. The label was visible on products when browsing the store. There exists another example in the market of climate decision information given on individual products *before* purchase, namely the sustainability label of Coop.se. This label depicts each product's score on several sustainability dimensions, including climate impact. However, this label differs from that of mat.se in that it is not visible when browsing products. To

see the information, the customer must also click on a product and then click on a button that shows the sustainability info. This lack of visibility makes this label less salient.

There are more examples of decision information given *before* purchase in the retailers' recipe pages. The label is usually shown when clicking a climate-friendly recipe, but in a few cases also when browsing recipes. Ica.se and Føtex stand out as the only actors who give climate information on most recipes, not only the climate-friendly ones, by presenting a label with one to three green leaves depending on the impact.

4.2. Decision structure type interventions

We could only find a few nudges using decision structure techniques in the sub-category *changing option-related effort* (B2) and only a single one in the sub-category *change option consequences* (B4). We did not observe any nudges in the categories *change choice defaults* (B1) or *change the range or composition of options* (B3).

Decision structure interventions promote climate-friendly products by making them easy to choose. Providing a climate-friendly category for recipes, and sorting on climate footprint, can be considered both a decision information nudge and a nudge changing option-related effort. In addition to providing information about which recipes have low footprints, such measures make it easier for customers to find and choose these recipes. We found both of these types of nudges in several online retailers.

The intervention that fits the definition of changing option-related effort most clearly is the climate-friendly option banner of mat.se. The flag was shown at the top of the page for search results on popular animal products, suggesting climate-friendly alternatives. For example, when logged-in customers searched for milk, plant-based options such as oat milk and soy milk appeared at the top of the list on a green background. This meant that the easiest option for a customer searching for milk would be choosing a plant-based one.

Another example is a green button that the Danish actor Føtex has on many of their recipes where the customer can "shift the ingredients with one click" to greatly reduce the climate footprint. When clicking the button, the customer will be directed to a similar recipe with a lower footprint. This is usually done by switching out the proteins, like switching beef with chicken, fish, or beans.

The one nudge changing option consequences that we could identify was Hemköp's loyalty program which gives the customer extra bonus points for choosing the green product of the week. This can be considered a micro incentive because the small financial incentive of extra bonus points could have a larger effect than what the monetary amount would entail from a rational choice perspective.

4.3. Decision assistance type interventions

We found no examples of retailers *providing reminders* (C1). There could exist nudges of this type in the form of newsletters or social media campaigns that we did not pick up. However, if these types of reminders are sent out on an ad-hoc basis, with no apparent consistency, we have not defined them as climate nudges.

Our findings show only one clear example of a nudge *facilitating commitment* (C2). The Finnish actor K-food allows customers to set a climate goal in their climate dashboard and monitor their performance. The app suggests a goal based on the historical consumption of the customers.

In addition, a couple of actors offer climate-friendly meal-kit subscriptions. These could be seen as a way of facilitating commitment, since buying one of these would mean committing to eating climate friendly for the duration of the subscription.

5. Discussion

5.1. Online retailers currently rely on information

Decision information is the most common nudging technique deployed by Nordic online retailers today. Decision information nudges are easily detectible for customers and other stakeholders, and these types of nudges can therefore have a positive effect on branding and customer satisfaction by being a sign of corporate social responsibility. Research has shown that disclosing environmental information can have a positive effect on stock prices, which would provide strong incentives for decision information nudges (Taufique et al., 2022). Another reason why information is most common might be because information such as climate labeling has been used by physical retailers for years, and therefore seems like a well established and tested form of nudging. Food retailers are already providing information about their products, and so providing climate information in addition to that might not be considered intrusive by the retailer.

Although some form of climate information can be positive for branding, retailers might also be concerned that information can be considered moralizing, distracting or controversial, and create negative backlash from some customers. This might be why current information nudges in the market can rarely be described as neither salient nor timely. Climate labels are often subtle and blend in with the rest of the content on the page, and customers often have to click on the recipe/product and, in the case of Coop's sustainability label, on a specific button to see the actual information. In a physical store, customers might put the regular items in the cart, barely looking at them. Online grocers should take advantage of having more control over what the customer sees, for example by making sure the climate label is visible at all types of views and not only on the product page.

Common to many of the present nudges in the market is also that the climate information is not very timely; it will reach the customer *after* purchase or at some unknown time which may be far from the time of decision-making. For example, this was the case for all nudges providing feedback on a customer's own footprint. Effective timing could be achieved through product carbon labels, timing the information to when customers decide which items to buy. Online retailers also have the opportunity to present information such as total order footprint at some point *right before* checkout and payment, and they can use their vast data collection to identify other times when a customer is most prone to making a shopping decision.

With the current preponderance of information nudges in the Nordic market, retailers also rely on their customers having quite a high motivation to choose climate-friendly options. This is both in the sense that customers often have to seek out this content to find it, and that motivation is a prerequisite for information to affect behavior (Mertens et al., 2022).

An illustration of this is that mat.se reported a 5 % reduction in their most conscious customers' climate footprint due to the introduction of their product level carbon label, compared to a 3 % reduction for the whole sample. *Conscious* was defined as customers buying relatively more products with labels such as *fairtrade* and *ecological* (mat.se, 2020). Online food platforms can take advantage of their possibility to personalize and thus target the most receptive customers with their information nudges.

When it comes to those presenting emissions data, all Nordic retailers do this at the category level. There are good reasons for this, including that there is no highly adopted, standardized way for suppliers to report on the life cycle emissions of their products. Since product level emission data must be bought through third-party suppliers, the retailer must consider the trade-off between the benefits and costs of higher accuracy in the data. With product level emissions data that differentiates between different products in the same category or sub-category, retailers can facilitate within-category substitution to greener products and stimulate increased competition by suppliers on climate impact. However in practice, the differences between databases stemming from differences in methodology can mask or amplify possible differences found between products, limiting the added value of the increased granularity. Moreover, the added uncertainty around a product's emissions when comparing different numbers coming from different studies and methodologies can lead to debate and controversy among suppliers and customers around the specific numbers. This perspective is essential since trust in the information provided is one of the most important drivers for adoption and support of labels (Kaufman et al., 2020). Since LCAs are complex, and there are many misconceptions among consumers around the climate impacts of food products even at an aggregate food group level, retailers must be conscious of presenting climate information in a clear and simple way, to avoid confusing the consumers further. This involves finding a balance between enough and too much information, without masking real differences or variations. There are considerable environmental benefits to shifting consumption from ruminant meat to plant-based or other animal-based proteins (Hoolohan et al., 2013). Thus the largest potential might lie in presenting this more aggregated information to the customers. However, more research should be done on which aggregation level of emissions data is most effective in decreasing consumers' footprints.

There are indications that climate information is important to support changes in consumer behavior towards more climate-friendly patterns, and can be made more effective by improving saliency and timing. Still, it is likely insufficient to obtain large consumer demand changes. By focusing on decision information nudges, retailers seem to rely on a lack of information about what constitutes a climate-friendly diet as the main barrier to climate-friendly food consumption. Decision structure and decision assistance nudges seem to be more promising for those customers least concerned with sustainability issues and motivated for change.

5.2. Untapped potential in decision structure and assistance nudges

Decision structure and decision assistance nudges are still rare in the Nordic market. This is despite the fact that when looking to the current literature on the effect of nudges, there is reason to believe that the decision structure nudges we observed might have the most potential to reduce consumers' footprints. These nudges substantially lower the efforts needed to make climate-friendly decisions, require minimal cognitive effort, and even facilitate more automatic decision-making processes. For the same reasons placing low-emission food products or recipes on the front page and high up on search results are subtle decision structure nudges that could have large effects. Online grocery stores also have the opportunity to set climate-friendly options as defaults, for instance, by making soy or pork mince the default mince in recipes or making pre-defined shopping lists climate-friendly.

Apart from one example of a bonus program awarding extra bonus points for climate-friendly choices, we found no nudge changing option consequences. There is evidence suggesting that combining nudges with traditional economic measures like price incentives, could produce stronger effects than these measures do in isolation (Nisa et al., 2019). Adding for instance a label to a climate-friendly product that is on sale could compare favorably to giving the customer a larger financial incentive. Another untested nudge in the Nordic market is changing option consequences by allowing customers to make their footprint public by sharing it on social media platforms. This could be built on the decision information nudge of providing social reference points that some actors have implemented.

In our mapping we found few decision assistance measures in the Nordic market. Decision assistance nudges can, through goal setting and reminders, be a way to foster greener habits by increasing long-term engagement. The possibility of tracking purchases and providing feedback in online grocery stores can easily allow for individual goal-setting features, such as the one implemented by K-Citymarket. Moreover, recognizing the effects of reminders, most online retailers already send out reminder emails or push notifications to nudge consumers back onto their platforms. A message reminding customers to shop climate friendly could easily be incorporated into these features, boosting habit creation by increasing engagement and the frequency of the climate-friendly action.

5.3. Collecting and presenting climate data might become a competitive necessity for food retailers

Globally, around 60 % of consumers say that sustainability concerns have an influence on their eating habits and think businesses can do more to make the food system sustainable, and 57 % even believe that sustainability labels should be compulsory on food labels (The European Consumer Organisation, 2020; WWF, 2019). Furthermore, legislation might be on the doorstep. The European Union has announced in its Farm-to-Fork strategy the development of a sustainable food labeling framework to empower consumers to make more sustainable food choices (European Commission, 2020). Climate nudging from private sector initiatives will be important to inform these regulatory processes. Moreover, private sector standards have been shown to often be more influential in the market than public standards, and being a first mover can give a competitive advantage (Taufique et al., 2022).

Many Nordic online retailers have started implementing some sort of digital climate nudge and have set targets they will be working on achieving. Given the size of Scope 3 emissions and how much it comes from the production stage of the food product life cycle, it will be difficult for food retailers to reach their goals without targeting their customers' climate footprints. Therefore, there is reason to believe that these types of tools will be increasingly commonplace in the market and thus considered a minimum by consumers. Given this development and the fierce competition in the market for online food retail, it could be advisable, even from a business perspective, for food retailers to introduce more ambitious and effective climate nudges to position themselves at the forefront and build resilience to future disruption (Bartosz et al., 2022). Experimenting with decision structure and decision assistance interventions is a promising route for retailers, especially those who have collected most of the possible gains from decision information. Putting in place multiple nudges that impact behavior through different mechanisms might be a particularly effective way to see considerable reductions in Scope 3 emissions, as interactions have been highlighted as having great potential for promoting sizable changes in sustainable consumption (De Bauw et al., 2022; Nisa et al., 2019).

5.4. Limitations

This review maps current climate nudges in Nordic online food retail and discusses their potential effect based on the existing scientific literature on the effects of different types of nudges. It is important to note that we have not collected any data on the interventions mapped in this paper and thus cannot state anything about the effects of these specific nudges on consumer choice and footprints. Future research should explore the effects of the climate nudges implemented by the online food retailers on customer behavior, to better inform the development of such interventions in other online retailers.

Our focus is on nudges targeting the climate footprint from food production, as these Scope 3 emissions contribute to the largest part of food retailers' total emissions. Our study excludes Scope 1 or 2 emissions, such as nudging towards more climate friendly delivery options. We did not include nudges targeting food waste reduction in the mapping. We came across some examples of food waste reduction initiatives using price reductions on products close to the expiring date, however price reductions are not typically considered nudges. More research on the climate effects of food waste and transportation nudges could be an important contribution to the literature and to food retailers' sustainability work. Further research should also explore nudges that target sustainability dimensions beyond climate impact, such as health, animal welfare or social inclusion.

As with most taxonomies, it is not always clear-cut in which category each intervention should be placed, and some could belong in several of the categories. For instance, it is possible to argue that some of the decision information nudges could also be defined as decision structure nudges since they both present information about climate impacts and make it easier to choose these products. Combinations of information and structure-type nudges could be especially prominent in digital contexts, where it is easy to make digital information actionable. An example of this is the climate banner on mat.se, which provides information about what is the low-emission options and makes these options easy to choose. These types of twin effects should be taken into account in further development of nudging taxonomies intended for the digital environment.

6. Conclusions

As of September 2022, the most forward-leaning Nordic online grocers have implemented several digital nudges to influence customers to buy food with lower climate impact. Nevertheless, there is a range of possible ways for online grocers to impact consumers, and so far few of them are being exploited. Most of the current nudges are of the decision information type. They mainly consist of translating information and making it visible, usually in the form of personalized feedback on footprint that can be accessed on a dedicated page on the website or in an app. For retailers with recipe pages, some type of indication of what recipes have low footprints is quite common. Many of these nudges likely have limited effects due to their reliance on motivation and reflection, and suboptimal timing and saliency. The types of nudges that have been shown to be the most effective in the literature on nudges, decision structure nudges, are absent from most platforms. More effective measures must likely be put in place for retailers to reach their own goals and obtain the diet changes needed to combat climate change. Online food retailers are positioned to influence the transition to a climate-friendly food system. This review of measures in place today will hopefully inspire and guide retailers considering green nudges in the Nordics and beyond. Effective climate nudging by online grocers can significantly impact the environmental footprint of their sales and the global food system at large.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

Appendix A. Examples of the design of digital climate nudge interventions from a Norwegian online grocer
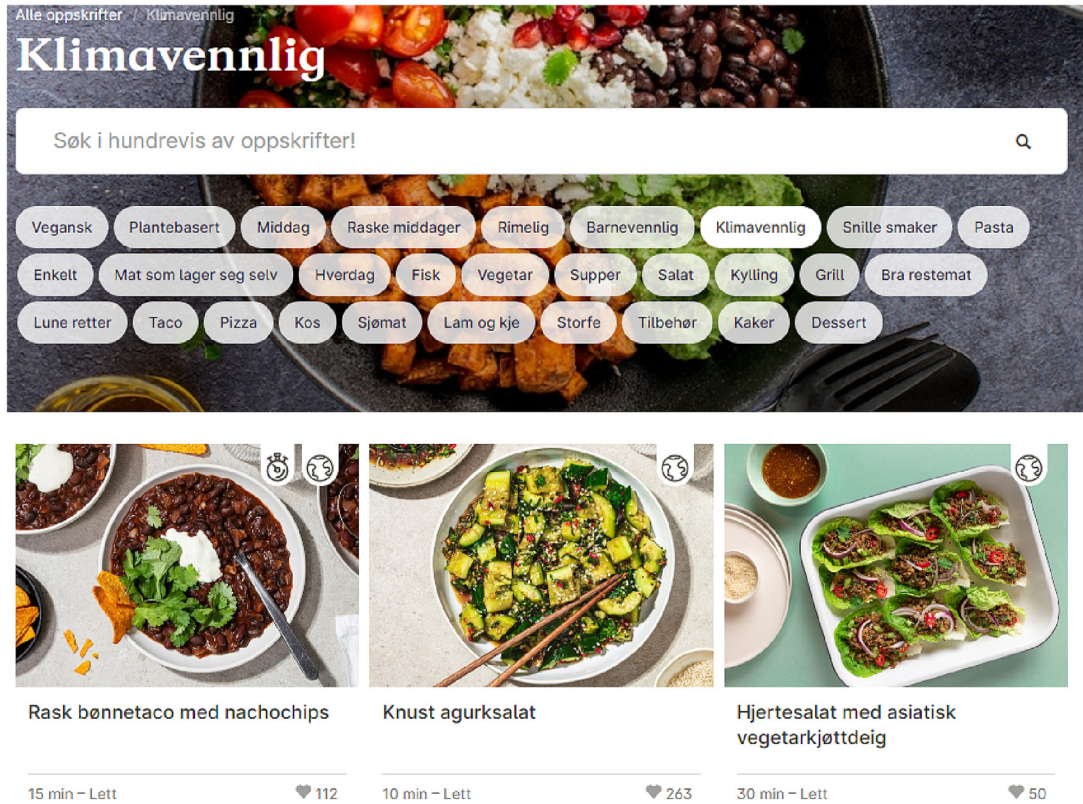
Fig. 1. Screenshot of Oda's recipe climate label (https://oda.com/no/recipes/tags/114-klimavennlig/, retrieved 25.11.2022). When you choose the category "Climate-friendly", only the recipes with a globe symbol appears.
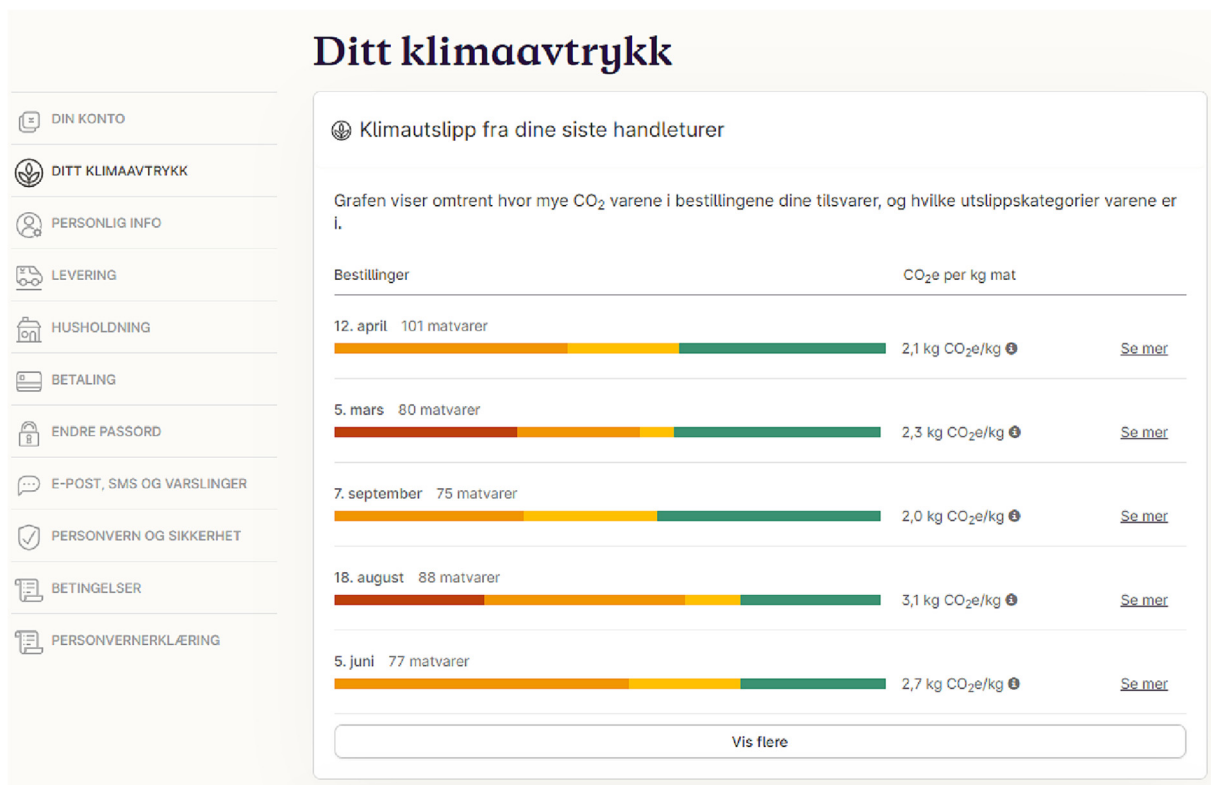

Fig. 2. Oda's climate dashboard. The dashboard shows a footprint for each order the customer has made, and with a color scheme from red to green indicates how climate-friendly the different products in the order were. By clicking "See more", the customer can see which individual products in the order landed in which emission category.

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