

EXPLORING DIGITAL BEHAVIOUR INTERVENTIONS TO ENCOURAGE SUSTAINABLE CONSUMER DELIVERY CHOICES

ABSTRACT Full Paper

Purpose

Currently, 74% of EU internet users aged 16-74 ordered goods and services online (Eurostat, 2021). Same-day and instant deliveries, which have the highest CO2 emissions of all delivery options, are the fastest-growing services in last-mile delivery (World Economic Forum, 2020). Amidst this, digital behaviour change interventions on e-commerce sites that convincingly frame, encourage, and incentivise the use of green delivery and local pick-up of ordered goods are necessitated. The aim of the research is to investigate the scientific landscape for studies that deal with theoretical approaches and methods for digital interventions in e-commerce shopping. Furthermore, it will be investigated whether the results of these studies are reflected in practice.

Methods

The method is twofold. First, a limited meta-analysis of studies concerning the use of digital behaviour change interventions for sustainable consumer delivery choices during the ordering and delivery process of the customer purchase journey was carried out. These included ten research studies during the period 2018-2024 identified on the Scopus, Web of Science and Google Scholar databases via an iteratively updated keyword search. The retrieved studies respectively their examined behaviour change techniques were then classified according to the Behaviour Change Taxonomy by Michie et al. (2013). Secondly, an e-commerce website analysis of the top 65 e-commerce sites by net revenue in 2022 (EHI Retail Institute, 2023) was conducted to identify which, if any, of the theoretically identified behaviour change interventions that promote sustainable delivery and pick-up options were utilised.

Findings

Among the ten studies analysed, we found eleven main theoretical and conceptual approaches (predominantly *sustainable consumer behaviour* and *nudging*), four methods (predominantly using online surveys with a mock web page/shopping basket and stated preference surveys), and six types of behaviour interventions (predominantly *information about social and environmental consequences* and *restructuring the physical environment*).

Among the 65 websites analysed, three percent currently employed one or more behavioural interventions (one pet shop and one drug store). Interestingly, the lack of systematic and overarching analysis on this topic presents the need for a new research agenda that unifies and defines courses of action based on connecting these different studies.

Research limitations/implications

In order to extend the already limited number of studies in this area, our meta-analysis extended its scope to include two master theses alongside eight peer-reviewed studies. Additionally, only interventions for consumer delivery choices were considered, and not returns. Furthermore, the lack of standardised vocabulary on this topic may have hindered the number of studies included in this research. Only English-speaking studies were analysed.

Practical implications

This research can serve as a guide for online retailers to make an informed decision about which applications they would like to implement in practice. This state of the art can inform further developments in this area.

Original/value

To our knowledge, this is the first (limited) meta-analysis on behavioural interventions for sustainable consumer delivery choices on e-commerce sites. Additionally, compared to the current studies, our research is the first to our knowledge that extrapolates the cross-domain behaviour change technique taxonomy of Michie et al. (2013) into the application area of sustainable consumer delivery choices and codifies the current work, preparing ground to a unified classification. The contribution to the research field is to thoroughly analyse current work done in this field theoretically, methodologically and in practice, and to try to chart further courses of action. The value is to lay the foundation for a new research agenda and provide evidence for success factors of employing behavioural interventions in order to serve logistics providers, e-commerce practitioners, and the climate.

Keywords: *Sustainable logistics, consumer behaviour, last-mile delivery, sustainable consumerism, e-commerce, behavioural intervention, behaviour change technique, nudging*

1. INTRODUCTION

E-commerce deliveries are increasingly rising, and although its environmental impact in Europe is said to be lower than retail stores (OliverWyman, 2021), it still contributes substantially to air and noise pollution, traffic congestion and greenhouse gas (GHG) emissions. The COVID-19 pandemic further increased the use of e-commerce retail, with global sales growth rates of 26.7% in 2020, 16.8% in 2021, and it is forecast to continue, albeit with a slower growth rate of on average 8.5% in the years 2022-2026 (eMarketer, 2023). When looking into the last mile of delivery particularly, this final segment – transporting goods in parcels from local depots and delivery hubs to the final destinations – is also very expensive, and has gained more attention among e-commerce retailers, consumers, carriers and local authorities. The World Economic Forum estimated that last mile delivery accounts for 53% of the total cost of shipping and 41% of total supply chain costs. With no future interventions, the number of vehicles delivering parcels in major cities could increase by 36% by 2030, with associated increases of delivery emissions of 32% and congestion of over 21% (World Economic Forum, 2020). Even more, Higgs et al. (2022) estimate that the last mile represents approximately 50% of delivery CO₂ emissions in Europe.

Consequently, reducing the negative impacts and externalities of last mile delivery has been focused on operational solutions (Ignat & Chankov, 2020), particularly by looking at optimal delivery vehicles, logistics hubs and vehicle routing optimisation (Viu-Roig & Alvarez-Palau, 2020). However, amidst this, there is an increasing call for supply-side policies to be accompanied with corresponding demand side approaches that could aid consumers in making more sustainable choices (Lehner, Mont & Heiskanen, 2016). Yet, when promoting sustainable consumer delivery choices on the demand side, the prospect of online consumers' agency to choose the most sustainable choice has often been neglected (Buldeo Rai et al., 2021), and consumers are often unaware of the level of sustainability of e-commerce distribution (Sallnäs & Björklund, 2020). Nonetheless, it has been found that consumer changes can lead to pronounced effects; for example, compared to conventional home delivery, consumers who walk, bike or use an electric vehicle to pick up parcels at lockers or parcel shops can reduce GHG emissions by up to 30% (DHL, 2022).

1.1. ONLINE CONSUMERS' ROLE IN THE SUSTAINABLE LAST MILE

Consumers in recent years have become more aware of the environmental and social impacts of their purchases. Online shoppers now increasingly look for more sustainable products, packaging and delivery. In a DHL survey (2022) of online shoppers across nine European markets, 53% said that sustainability is important to them, and another survey found that 70% of European online shoppers are willing to accept additional costs for sustainability (Seven Senders, 2022). Furthermore, shoppers aged under 35 were twice as likely willing to pay for a green delivery and for sustainable packaging than shoppers aged over 45. Across all age groups, 58% are willing to wait longer for a greener delivery, and in all markets surveyed, shoppers preferred a longer wait instead of paying more for delivery (DHL, 2022). Even more, another international survey from GWI Zeitgeist found that among already eco-friendly online shoppers, 63% say the most important aspect when deciding what to buy is the presence of eco-friendly/carbon-neutral shipping – while cost is deemed less important (42%) (GWI, 2021).

Furthermore, to date, retailers are largely seen to be lagging with regard to helping make e-commerce more sustainable. As it stands, consumers have been equipped with little chances to influence more sustainable deliveries. It is vital that online retailers and logistics service providers provide the means necessary for consumers to exercise their (sustainable) preferences (Sallnäs & Björklund, 2020), and that consumers are involved in the co-creation of such constructions. Furthermore, the construction of such interventions that enable more sustainable delivery choices may possibly aid in closing the *green gap*, known as the inconsistency in what consumers say in terms of their level of environmental concern versus their actual environmentally directed behaviour (ElHaffar, Durif & Dubé, 2020; Muysoms et al., 2021); this attitude-behaviour gap has demonstrated to be very much present among e-commerce shoppers, e.g., in a Zalando study of online consumers (Heiny & Schneider, 2021).

1.2. ENCOURAGING SUSTAINABLE LAST MILE DELIVERY CHOICES WITH DIGITAL BEHAVIOUR CHANGE TECHNIQUES

In an attempt to guide and influence consumer behaviour, multiple behaviour change techniques (BCTs) stemming from psychology and behavioural economics, defined as “observable, replicable, and irreducible components of an intervention designed to alter or redirect causal processes that regulate behavior” (Michie et al., 2013:p.2), have been tested; for instance, nudging, persuasive strategies, visualisation, gamification and eco-feedback. A greater number of these interventions is increasingly digitally mediated and focused on smartphones (Hedin et al., 2019). The use of BCTs is predominantly well-known in the applications of health and well-being (Michie et al., 2013); as found from its application in the health sector, a stronger effect of BCTs were found when they came from a foundational basis (Van Rhoon et al., 2020). However, BCTs and their corresponding taxonomy are interdisciplinary and can be transferred across different application areas (Michie et al., 2013), which is not limited to mobility (e.g., Krusche et al., 2022; Luger-Bazinger, Geser, et al., 2023; Luger-Bazinger, Thelen, et al., 2023) and shopping on e-commerce sites (Petersson, 2022) Thus, extending the application of grounded BCTs into the realm of e-commerce and logistics to influence consumer delivery choices is worthwhile.

Most prominently, nudging (Thaler & Sunstein, 2008) is used to guide decisions without restricting or banning options and works by changing the so-called choice architecture, for example, by giving reframing choices through providing different or new information. In this context, the presentation of choice architectures is not neutral, with the possibility to significantly sway decision-making. However, nudging interventions are perceived to be unobtrusive and prompt consumer choices without involving much mental energy. Attempts to guide sustainable consumer behaviour towards a desired selection have sought to address cognitive barriers by introducing concepts such as “future focus”, which focuses on producing clear informational messages to address uncertainties (Trudel, 2019). This has been extended to the concept of “green nudges” which aim to nudge towards sustainability (Schubert, 2016). In online retail, the use of non-financial enticements versus differential pricing and financial incentives have been increasingly explored to incentivise consumers to make a desired choice (Buldeo Rai et al., 2021). Even more, a combination of financial incentives and non-financial BCTs could possibly be more effective than either of these done separately (Nisa et al., 2019).

To date, influencing online consumers' sustainable delivery choices with digital interventions has been devised around three features of the last mile: (1) *delivery speed*, by influencing consumers to choose a slower delivery speed, and thereby better optimising vehicle loads and delivery consolidation; (2) *delivery time*, by influencing consumers to choose a delivery time of day that suits them, and thereby reducing the risk of delivery failures and second redeliveries; and (3) *delivery location*, by influencing consumers to choose collection points, pick-up stations and delivery lockers (Ignat & Chankov, 2020; Buldeo Rai et al., 2021). For example, customers have been incentivised to delay the speed of the delivery in order to make this delivery a greener option. Such digital interventions can manifest into varying forms, including but not limited to the (1) *default rule*, where the more sustainable delivery choice is already picked, (2) *disclosure*, where a specific delivery choice is labelled as sustainable, or (3) *social reference/social comparison*, where it is displayed that a certain amount of people already chose the desired option (Muysoms et al., 2021). In this context, new consumer facing CO₂ calculator tools to measure emissions of different delivery options on e-commerce sites have come to the fore, e.g. Bewust Bezorgd (Thuiswinkel.org, n.d.).

In a study, Bewust Bezorgd's interventions that provided information concerning the calculated CO₂ impacts of various deliveries resulted in double the consumers selecting their delivery at a collection point, which was displayed as the most sustainable option. Furthermore, when a CO₂ information display is combined with a green leaf alongside the most sustainable delivery option, the most sustainable option was selected almost four times more often compared to no intervention (ECommerce Europe, 2021). However, as it stands, there is lack of comparability and communication of CO₂ emissions of various freight transport options, which limits the effectiveness of CO₂ accounting to inform decisions by organisations and incentivising eco-friendly consumer choice (Tölke & McKinnon, 2021).

The overall take-up of freight transport CO₂ accounting and communication is still limited, especially by SME carriers, as a small number (25%) of them are able to calculate transport-related emissions at a consumer level (Tölke & McKinnon, 2021). While different CO₂ calculators are available, these are data-intensive and often complex to carry out; as such, CO₂ emissions are more often calculated in an aggregate company-level (Tölke & McKinnon, 2021; Dubisz, Golinska-Dawson & Zawodny, 2022), e.g., to be used in CO₂ offsetting programs, while seldom implemented in e-commerce platforms to inform consumers about the environmental effects of different delivery and return options. For this, the support of logistics companies is paramount (Petersson, 2022). Moreover, the displaying of such calculations is a balancing act for online retailers, as they do not want to display too much information and make it too complex for customers just as they are about to buy their items (Sallnäs & Björklund, 2020), running the risk of cart abandonment. Here, careful implementation of BCTs is warranted to ensure that they do not come at the cost of hurting profitability of e-commerce sites. To summarise, there is a knowledge gap concerning the success factors of employing BCTs that incentivise sustainable consumer delivery choices based on the effect of ecological impact information.

1.3. EXTRAPOLATING INTERVENTION METHODS FROM SUSTAINABLE PRODUCT MARKETING TO SUSTAINABLE DELIVERY: SUCCESS FACTORS AND DETERMINANTS

To date, studies concerning sustainable consumerism have tended to centre around specific product attributes instead of services like logistics (Frick & Matthies, 2020). Although the use of consumer facing digital behaviour interventions to promote ‘green’ delivery is still embryonic, the use of other such digital interventions to encourage the purchasing of sustainable products in an online setting is somewhat more mature, e.g., employing BCTs in online grocery stores to foster sustainable food choices (Berger et al., 2020, which tested digital defaults, simplification and social norms), or on e-commerce fashion sites to encourage sustainable clothing purchases (Mirbabaie et al., 2021, which tested digital defaults and social norms). Furthermore, in studies thus far, equipping consumers with knowledge about the possible consequences and ecological impacts of their choices are seen to be generally promising when transferred and applied in different domains and application areas (Buldeo Rai et al., 2021). Given the background of the aforementioned studies, we identify a gap in the success factors of BCTs in the online customer journey process of last-mile delivery mode selection. Our research objective is, amidst calls to develop an overarching, expert-accepted taxonomy of behaviour change techniques that are found and applicable in a vast area of domains, the behaviour change technique taxonomy developed by Michie et al. (2013) has introduced a cross-domain, interdisciplinary classification of distinct BCTs.

In principle, delineating which BCTs were utilised in a specific case, these have the possibility to be transferrable to a different application area. With that being said, attempts have previously been made to transfer BCTs to the mobility sector (e.g., Krusche et al., 2022; Luger-Bazinger, Geser, et al., 2023; Luger-Bazinger, Thelen, et al., 2023) and in the e-commerce industry (e.g., Petersson, 2022). In doing so, discovering which BCTs have been studied or conducted in practice within the domain of consumer behaviour with regard to sustainable products on e-commerce sites can enable discovering possible new implementations of BCTs which have been un-explored within the realm of promoting ‘green’ delivery on e-commerce sites. This could possibly enable new insights into how to design BCTs in the e-commerce and logistics application area.

2. METHODOLOGY

To gain an overview of tested and implemented behaviour change interventions that motivate sustainable consumer delivery choices on e-commerce sites, a limited meta-analysis of current interventions which aim to promote sustainable consumer delivery in studies and in practice has been conducted. Thereafter, the website analysis is conducted in order to find theoretically based interventions in practice on e-commerce sites, in contrast to those BCTs are found to be the most effective in the literature. The classifications of specific BCTs are based on the behaviour change technique taxonomy from Michie et al. (2013), as it is an expert-formulated classification of the most prominent behaviour change techniques that is industry and sector-

agnostic and universally transferrable across research and practice domains. We surmise that the BCT categories *information about social and environmental consequences* and *social comparison* will be the most prominent within the context of e-commerce and logistics incentivisation.

2.1. SEARCH PROCESS

The meta-analysis was carried out in February-March 2024. First, a Scopus, Web of Science and Google Scholar database search was conducted to identify studies which have already scientifically tested digital behaviour change interventions to promote sustainable consumer delivery choices. The following keywords were used: “sustainable online delivery choices”, “sustainable e-commerce nudges”, “sustainable delivery nudging”, “sustainable pick-up nudging”, “sustainable delivery choices”, “consumer sustainable delivery preferences”, “consumer preferences for sustainable delivery incentives”, and “green consumer delivery choices”. The process of choosing search terms was iterative, as new terms were discovered during the literature review process. The keywords in finding the studies were all in English. The search resulted in ten studies (including eight peer-reviewed papers in academic journals and two master theses) ranging from 2018-2024.

Thereafter, the most effective behaviour change intervention(s) found from the study in question was extracted. First, all e-commerce site interventions seeking to influence or promote sustainable consumer delivery choices were classified. Secondly, the identified interventions were clustered into categories, selected and adapted for the mobility field from the Behaviour Change Technique Taxonomy (Michie et al., 2013), an all-encompassing taxonomy of expert-filtered and distinct behaviour change techniques used in behaviour change interventions.

Secondly, the top 65 B2C online retailers in Germany by net e-commerce revenue in 2022 (EHI Retail Institute, 2023) were analyzed by one researcher and screened to identify if and which type of behaviour change interventions to promote greener delivery or pick-up options, and of these, which types of interventions were utilised. For this purpose, German online retailers were chosen due to the availability of information concerning the most prominent shops by net revenue and its expansive market size in the European Union. As most sites require a membership registration in order to check out and complete the order, dummy accounts were created. Thereafter, a product from the corresponding online retailer was chosen, and the customer journey until payment was analyzed. The study analyzed the customer journey steps up until the final section, the payment, and thereafter the cart was abandoned. The resulting consumer journey steps were tabulated and coded in an Excel spreadsheet.

2.2. SELECTION CRITERIA

For both the meta-analysis and e-commerce site analysis, it was a requirement that the objects of research are (1) consumer-facing, (2) fixated on encouraging sustainable consumer behaviour regarding choosing greener delivery options or products, (3) include at least one BCT, and (4) are digitally mediated BCTs in place of analogue. It is worth noting that this study excluded interventions which were about product returns.

3. FINDINGS

3.1 META-ANALYSIS RESULTS: THEORETICAL APPROACHES, EMPLOYED INTERVENTIONS AND SAMPLING

Upon a review of the literature, ten studies were found to have studied and tested the effectiveness of formulated BCTs for sustainable consumer delivery choices on either fictitious e-commerce sites or via a survey. This is an emerging topic, as the earliest cited study is 2018 – with the bulk of the studies having been conducted from 2021 onwards. Of the ten studies, ten tested home delivery, three tested pick-up station delivery, and one tested the use of parcel lockers. The studies were conducted among a sample predominantly in Europe, with the Netherlands (three studies), Belgium (two studies), United States (two studies) and the United Kingdom (two studies) being the most represented.

Theoretical and conceptual basis

The ten studies engaged in this review were rooted on varying theoretical and conceptual bases, ranging from supply chain management (Buldeo Rai et al., 2021), consumer centric supply chains (Thomas, Ueltschy Murfield & Ellram, 2022), social exchange theory (Thomas, Ueltschy Murfield & Ellram, 2022), behavioural economics (Thomas, Ueltschy Murfield & Ellram, 2022), sustainable consumer behaviour (Ignat & Chankov, 2020; Nijssen et al., 2023; Agatz, Fan & Stam, 2021; Viet, de Leeuw & van Herpen, 2023), libertarian paternalism (Muysoms et al., 2021), theory of planned behaviour (Agatz, Fan & Stam, 2021), construal level theory (Viet, de Leeuw & van Herpen, 2023), cognitive dissonance theory (Viet, de Leeuw & van Herpen, 2023) and sharing economy (Caspersen & Navrud, 2021). Notably, the concept of nudging was a prominent theme throughout (Caspersen & Navrud, 2021; Kokkinou et al., 2024; Muysoms et al., 2021; Nijssen et al., 2023; Buldeo Rai et al., 2021; Thomas, Ueltschy Murfield & Ellram, 2022).

Behaviour change techniques

Here, the employed BCTs according to the behaviour change taxonomy by Michie et al. (Michie et al., 2013) are, in order by frequency:

Information about social and environmental consequences (frequency: 8)

Description: “Provide information (e.g. written, verbal, visual) about social and environmental consequences of performing the behaviour. Note: consequences can be for any target, not just the recipient(s) of the intervention” (Michie et al., 2013).

Use case(s): Displaying sustainability labels, green leaves, CO₂ calculations, better working conditions for delivery drivers, the number of trees saved, less freight traffic, less CO₂, increased safety, particulate matter calculations.

Social comparison (frequency: 3)

Description: “Draw attention to others’ performance to allow comparison with the person’s own performance Note: being in a group setting does not necessarily mean that social comparison is actually taking place” (Michie et al., 2013).

Use case(s): Displaying others’ delivery choices and others’ choices to share on social media.

Material incentive (frequency: 3)

Description: “Inform that money, vouchers or other valued objects will be delivered if and only if there has been effort and/or progress in performing the behaviour” (Michie et al., 2013).

Use case(s): Offering discounts for the most sustainable delivery mode.

Restructuring the physical environment (frequency: 2)

Description: “Change or advise to change the physical environment in order to facilitate performance of the wanted behaviour or create barriers to the unwanted behaviour (other than prompts/cues, rewards and punishments)” (Michie et al., 2013).

Use case(s): Setting the desired delivery mode as the digital default (i.e. “nudge”).

Identification of self as role model (frequency: 1)

Description: “Inform that one’s own behaviour may be an example to others” (Michie et al., 2013).

Use case(s): Offering customers the chance to share their sustainable delivery selection onto their Facebook page.

Behaviour cost (frequency: 1)

Description: “Arrange for withdrawal of something valued if and only if an unwanted behaviour is performed” (Michie et al., 2013).

Use case(s): Creating a cost surcharge for the undesired delivery option.

Study methodologies and sampling

Considering sampling, while some studies recruited participants via formal services such as Amazon Mechanical xTurk (Thomas, Ueltschy Murfield & Ellram, 2022) or Prolific Academic Service (Viet, de Leeuw & van Herpen, 2023), others recruited participants via social media (Ignat & Chankov, 2020; Buldeo Rai et al., 2021; Muysoms et al., 2021), mailing lists (Ignat &

Chankov, 2020; Buldeo Rai et al., 2021; Kokkinou et al., 2024; Caspersen & Navrud, 2021) and general snowball sampling (Buldeo Rai et al., 2021; Muysoms et al., 2021).

Regarding the research process, over two-thirds of the studies used an online survey software with mock web page/shopping basket (Thomas, Ueltschy Murfield & Ellram, 2022; Buldeo Rai et al., 2021; Nijssen et al., 2023; Muysoms et al., 2021; Viet, de Leeuw & van Herpen, 2023; Kokkinou et al., 2024; Michels et al., 2022) utilising a between subjects design (Thomas, Ueltschy Murfield & Ellram, 2022; Buldeo Rai et al., 2021; Nijssen et al., 2023; Muysoms et al., 2021; Agatz, Fan & Stam, 2021; Viet, de Leeuw & van Herpen, 2023; Kokkinou et al., 2024; Michels et al., 2022), while some utilised a stated-preference online survey (Ignat & Chankov, 2020; Viet, de Leeuw & van Herpen, 2023; Caspersen & Navrud, 2021), and one conducted an online simulator study (Agatz, Fan & Stam, 2021). Notably, only one study conducted an in-person survey in a field study (Fu & Saito, 2018).

Considering the interventions in question, some studies tested financial incentives (Ignat & Chankov, 2020; Agatz, Fan & Stam, 2021; Kokkinou et al., 2024), while a majority tested non-financial incentives (Thomas, Ueltschy Murfield & Ellram, 2022; Ignat & Chankov, 2020; Buldeo Rai et al., 2021; Nijssen et al., 2023; Muysoms et al., 2021; Agatz, Fan & Stam, 2021; Viet, de Leeuw & van Herpen, 2023; Kokkinou et al., 2024; Fu & Saito, 2018). Furthermore, half of the studies tested the use of a combination of non-financial incentives (Thomas, Ueltschy Murfield & Ellram, 2022; Buldeo Rai et al., 2021; Nijssen et al., 2023; Muysoms et al., 2021; Viet, de Leeuw & van Herpen, 2023) and three tested a combination of financial and non-financial incentives (Ignat & Chankov, 2020; Agatz, Fan & Stam, 2021; Kokkinou et al., 2024), while other studies tested singular interventions in isolation (Thomas, Ueltschy Murfield & Ellram, 2022; Buldeo Rai et al., 2021; Nijssen et al., 2023; Muysoms et al., 2021; Viet, de Leeuw & van Herpen, 2023; Kokkinou et al., 2024; Fu & Saito, 2018).

Lastly, the studies whose intervention was *Information about social and environmental consequences* utilised a wide variety of means to do so; namely, CO2 calculations (Thomas, Ueltschy Murfield & Ellram, 2022; Nijssen et al., 2023; Caspersen & Navrud, 2021; Fu & Saito, 2018), relative CO2 savings (Nijssen et al., 2023; Thomas, Ueltschy Murfield & Ellram, 2022; Viet, de Leeuw & van Herpen, 2023), personal impact statements (Thomas, Ueltschy Murfield & Ellram, 2022), description of less freight truck traffic (Buldeo Rai et al., 2021; Viet, de Leeuw & van Herpen, 2023), description of less ridden vehicles/vehicle kilometers (Buldeo Rai et al., 2021; Viet, de Leeuw & van Herpen, 2023; Kokkinou et al., 2024), description of sustainability (Buldeo Rai et al., 2021; Muysoms et al., 2021; Kokkinou et al., 2024), green leaf display (Nijssen et al., 2023), green label (Agatz, Fan & Stam, 2021; Viet, de Leeuw & van Herpen, 2023), better working conditions (Viet, de Leeuw & van Herpen, 2023), increased road safety (Viet, de Leeuw & van Herpen, 2023), relative particulate matter levels (Caspersen & Navrud, 2021), relative electricity use (Fu & Saito, 2018), recycled waste calculations (Fu & Saito, 2018) and trees saved calculations (Fu & Saito, 2018).

Table 1 Overview of literature on digital behaviour interventions for sustainable delivery options

Author	Sample Size	Country	Delivery Type(s)	Tested BCT(s)	Most Effective BCT(s)
Muysoms et al. (2021)	497	BE	Home delivery	Restructuring the physical environment (digital default); Information about social and environmental consequences (sustainability label); Social comparison (others' choices)	Combination of Restructuring the physical environment (digital default) & Information about social and environmental consequences (sustainability label)
Nijssen et al. (2023)	1213	NL	Pick-up station	Restructuring the physical environment (digital default); Information about social and environmental consequences (green leaf, CO ₂ calculation, relative CO ₂ savings)	Restructuring the physical environment (digital default),
H. Buldeo Rai et al. (2021)	403	BE	Home delivery	Information about social and environmental consequences (less freight truck traffic, less ridden vehicle kilometers, sustainability); Restructuring the physical environment (digital default); Identification of self as role model (social media sharing); Social comparison (others' choices to share on social media)	Combination of Information about social and environmental consequences (sustainability label) & Identification of self as role model (social media sharing); Social comparison (others' choices to share on social media)
Agatz et al. (2021)	1032	US	Home delivery	Information about social and environmental consequences (green label); Material incentive (discount)	Information about social and environmental consequences (green label)
Ignat & Chankov (2020)	248	DE	Home delivery, pick-up station	Information about social and environmental consequences (CO ₂ calculation, better working conditions); Material incentive (discount)	Information about social and environmental consequences (CO ₂ calculation, better working conditions)
Fu & Saito (2018)	434	MX	Home delivery	Information about social and environmental consequences	Information about social and environmental

				(electricity saved, CO ₂ saved, waste saved, trees saved);	consequences (trees saved)
Thomas et al. (2022)	113, 115	US	Home delivery	Information about social and environmental consequences (CO ₂ calculation, reduce personal impact); Material incentive (discount); Social comparison (others' choices)	Information about social and environmental consequences (CO ₂ calculation)
Viet et al. (2023)	348, 1387	NL, UK	Home delivery	Information about social and environmental consequences (less freight traffic, relative CO ₂ savings, better working conditions, increased road safety)	Information about social and environmental consequences (less freight traffic, relative CO ₂ savings, better working conditions, increased road safety)
Kokkinou et al. (2024)	228, 258	NL	Pick-up station, parcel locker	Information about social and environmental consequences (less vehicle kilometers driven, less environmental impact); Behaviour cost (surcharge for undesired delivery option)	Behaviour cost (surcharge)
Caspersen & Navrud (2021)	513 (female only)	NO	Home delivery	Information about social and environmental consequences (CO ₂ calculation, particulate matter calculation)	Information about social and environmental consequences (CO ₂ calculation, particulate matter calculation)

3.2 E-COMMERCE SITE ANALYSIS: BEHAVIOUR CHANGE TECHNIQUES IMPLEMENTED IN PRACTICE

Out of the 65 online retailers screened, two shops have implemented at least one BCT to encourage green consumer delivery choices: ZooPlus and Dm. Considering delivery option, both sites promoted home delivery, and one promoted pick-up station delivery. Additionally, both BCTs were displayed during the final phase of the customer journey. An overview is below:

Table 2 Overview of digital behaviour techniques for sustainable delivery options

Name	Type	Country	Delivery Type(s)	Implemented BCT(s)
ZooPlus.de	Pet store	DE	Home delivery	Information about social and environmental consequences (better working conditions)
Dm.de	Drug store	DE	Home delivery, pick-up station	Information about social and environmental consequences (less CO ₂); Restructuring the physical environment (digital default)

The utilised BCTs according to the behaviour change taxonomy by Michie et al. (Michie et al., 2013) are:

Information about social and environmental consequences (frequency: 2)

Restructuring the physical environment (frequency: 1)

Versandoptionen

 **Haustürzustellung**

☐ Standardversand
Wir wählen den besten Lieferservice für Sie. 0,00 €

☐ Lieferung mit DHL 0,00 €

☒ **Lieferung mit Hermes** 0,00 €

☒ **Lieferung zum Wunschtermin**
Entschuldigen Sie, der von Ihnen gewählte Service ist noch nicht verfügbar. Wir arbeiten daran, diesen bald anzubieten. 1,99 €

☐ Ich verzichte auf eine schnellstmögliche Lieferung (bis zu 3 Liefertage zusätzlich). Dies ermöglicht es uns, die Paketzusteller und Paketzustellerinnen auf der letzten Meile zu entlasten.

Figure 1 BCT used on Zooplus.de (translation: “I waive the fastest possible delivery (up to 3 additional delivery days. This allows us to relieve the burden on parcel delivery staff on the last mile.”)



Figure 2 BCT used on Dm.de (translation: “Environmentally friendly delivery option by avoiding transport-related CO2 emissions.”)

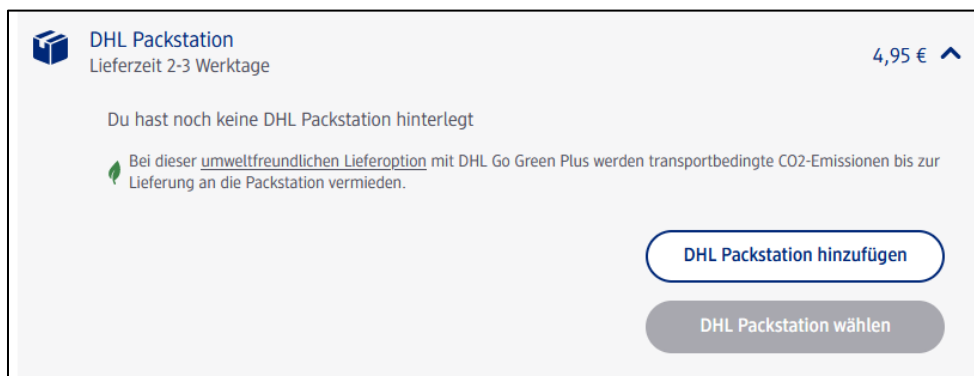


Figure 3 BCT used on Dm.de (translation: “With this environmentally friendly delivery option with DHL Go Green Plus, transport-related CO2 emissions are avoided until delivery to the Packstation.”)

4. DISCUSSION

Priming vs. non-priming

Notably, only one study primed the respondents before disclosing sustainability information, which was found to have a strong effect (Viet, de Leeuw & van Herpen, 2023). This also confirms prior studies which reveal that priming sustainability concern will increase consumers’ awareness of sustainability matters, and in turn, make sustainability a more prominent aspect in their decision making (Lee et al., 2020). Notably, future courses of action can test the additional effectiveness of including priming methods alongside said BCTs.

Product type

Additionally, two studies noted the potential ramifications its use of fashion products in their makeshift e-commerce sites in their experiment (Viet, de Leeuw & van Herpen, 2023; Thomas, Ueltschy Murfield & Ellram, 2022), which is considered a ‘low involvement’ product that does not necessitate fast delivery (Thomas, Ueltschy Murfield & Ellram, 2022). In fact, out of the mentioned studies who have disclosed the product type in their experiment, half of them have

tested clothing and fashion products (Caspersen & Navrud, 2021; Kokkinou et al., 2024; Viet, de Leeuw & van Herpen, 2023; Buldeo Rai et al., 2021; Thomas, Ueltschy Murfield & Ellram, 2022), while one study tested grocery delivery (Agatz, Fan & Stam, 2021), and one study tested book delivery (Muysoms et al., 2021), and three studies did not segment per product category (Nijssen et al., 2023; Fu & Saito, 2018; Ignat & Chankov, 2020). However, different product categories have an influence on how shoppers rationalise and make their purchasing decisions considering time, money, and ease (Nguyen et al., 2019), where sustainability factors may also play a role. (Thomas et al., 2022), Buldeo Rai et al. (2021) and Viet, de Leeuw & van Herpen (2023) have called on future studies to include different product categories, such as ones that entice more instant gratification, to test the effects of ‘sustainability disclosure’, i.e., *information about social and environmental consequences*. This also does not coincide with the two types of online retailers which have put such digital behavioural interventions in our analysis, which were a pet store and drug store.

Beyond nudging

As stated, the concept of nudging was a prominent theme (Caspersen & Navrud, 2021; Kokkinou et al., 2024; Muysoms et al., 2021; Nijssen et al., 2023; Buldeo Rai et al., 2021; Thomas, Ueltschy Murfield & Ellram, 2022), whose paternalistic approach is focused on “incentivising positive choices by creating the conditions, social pressure, systems or environments in which people want to make a choice for their own benefit, or have to make little effort to “choose” a personally and social desirable course of action. ‘Choice architecture’ is the process of designing systems and services in such a way that the ‘good’ choice is the easy and rewarding one and it does not take much effort to make” (French, 2011:p.157). However, manipulating users’ choice architecture can be perceived as top down, paternalistic and controlling, and nudging by itself is insufficient to create a desired outcome; other forms of interventions are needed in conjunction (French, 2011). There is a call for interventions to be informed by customer insight and by noting what has worked in the past; rather than mindless choosing on the consumers’ side, reasoning is needed while making complicated choices (Grist, 2010, as stated in French, 2011). Future approaches can benefit from going beyond the passiveness of default selections and manipulation of choice architecture to engaging users to make complex and well-thought-out decisions by means of other forms of BCTs (French, 2011), such as the ones included in this paper and beyond.

Customer segmentation

Caspersen & Navrud (2021) recommends that last-mile delivery intervention solutions should best be personalised to satisfy different user preferences. Additionally, Buldeo Rai et al. (2021) recommends that testing user groups differing in age, gender, level of urbanisation, online consumption behaviour and opinions on sustainability. Further testing among groups that are more clearly less susceptible to acting on sustainability interventions is useful.

Complexity of interventions

Nijssen et al. (2023) tested different interventions of varying degrees of complexity and found that the most complex informational interventions of consumers’ environmental impact (e.g., displaying the number of grams of CO₂ saved, instead of merely stating that it is lower/higher in emissions) was more effective in getting consumers to choose the desired delivery option

than simpler messages. Further, Thomas, Ueltschy Murfield & Ellram (2022) has echoed the same findings.

Type of promoted delivery mode

Of the ten studies, a majority (eight studies) tested home delivery, three tested pick-up station delivery, and one tested the use of parcel lockers. Ignat & Chankov (2020) and Kokkinou et al. (2024) have tested different desired delivery modes in their experiments, where they gave respondents room to choose which desired option they preferred. Further research is necessitated to demonstrate how consumers, who are accustomed to free next day delivery, change their online shopping behaviour to accept surcharges for less sustainable delivery options (i.e., next day delivery). Further, framing the more sustainable delivery option as a discount is a relevant consideration in future research (Kokkinou et al., 2024), e.g., as done by Viet, de Leeuw & van Herpen (2023). Additionally, no study among the sample tested the use of different delivery vehicles from which the consumer can select for their delivery, such as last-mile delivery by cargo bikes – which most logistics service providers are already testing with for emission-free deliveries (Buldeo Rai, Verlinde & Macharis, 2019).

5. CONCLUSION

This study aimed to create an analysis of the state-of-the-art of harnessing digital behaviour change techniques to promote sustainable consumer delivery choices on online retailers, considering what has been done in studies and in practice by conducting a limited meta-analysis and a website analysis of the top 65 e-commerce sites in Germany by revenue (EHI Retail Institute, 2023). Among the ten studies analysed, we found eleven main theoretical and conceptual approaches (predominantly *sustainable consumer behaviour* and *nudging*), four methods (predominantly using online surveys with a mock web page/shopping basket and stated preference surveys), and six types of behaviour interventions (predominantly *information about social and environmental consequences* and *restructuring the physical environment*). Additionally, a variety of approaches have been utilised to explore customer sentiment; namely the use of priming mechanisms, exploring different product types, testing the desired delivery option as the default option, examining the effects of varying degrees of complexity of BCTs, and promoting particular delivery modes. Furthermore, among the 65 websites analysed, three percent currently employed one or more behavioural interventions (one pet shop and one drug store). Both the analysis of screened websites and reviewed studies have predominantly employed the BCT *information about social and environmental consequences*. Interestingly, there are a number of techniques tested in an experimental setting which have not yet been introduced in practice on the most prominent German e-tail sites (i.e., *behaviour cost*, *social comparison*); this gap between theory and practice necessitates further exploration. All in all, the recency of the few studies concerning this topic and the low number of online retailers employing behaviour change techniques for sustainable consumer delivery choices in our sample suggest that using BCTs within the context choosing sustainable consumer delivery choices is embryonic, however, an emerging topic which has started to gain traction in the past

few years. It is envisaged that this analysis can provide a clear picture of what has been done so far in this realm to inform future courses of action.

5.1. LIMITATIONS

Like all studies, this also carries its limitations. Additionally, this study employed a focus solely on interventions for consumer delivery choices, and not returns. Furthermore, the lack of standardised vocabulary on this topic may have hindered the number of studies included in this research. In order to extend the already limited number of studies in this area, our meta-analysis extended its scope to include two master theses alongside eight peer-reviewed studies. Furthermore, the meta-analysis did not assign statistical weights to the studies and did not statistically analyse the studies, as is customary in a meta-analysis (Borenstein, Hedges & Rothstein, 2007). Also, only English-speaking studies were analysed. Additionally, as there was a lack of a unified list of the top e-commerce websites in Europe, the scope was narrowed to test the top e-commerce sites in Germany, as it is the largest consumer market in the European Union (International Trade Administration, 2023).

5.2. DIRECTIONS FOR FUTURE RESEARCH

In light of the reviewed research and e-commerce websites, we recommend that future studies take into account the use of priming mechanisms, which was understudied in the literature sample. Additionally, it is recommended that future research extends the scope of varying product types (e.g., non-urgent vs. urgent) and analysing customer sentiment based on these distinctions. Additionally, further segmentation of respondents based on socio-demographic factors in future studies can identify target groups which are less susceptible to sustainable delivery interventions, and to define further courses of action that appeals to these customer groups. Lastly, future research can promote multiple desired delivery modes instead of only one (e.g., testing slow home-delivery options alongside pick-up station delivery options, as was already put into practice by dm.de in our website analysis) and to examine the disparity of effects between them. By presenting more than one desired delivery mode, customers can have more agency to choose between the different choices instead of being limited to only one real desired option. In the same way, desired last-mile delivery vehicles can be listed as a delivery option and promoted (e.g., cargo bike delivery by a local courier) via BCTs. As our study lays the foundation for the creation of novel BCTs for sustainable consumer delivery choices, an eventual next step is to create both a practice-based and theoretically based set of interventions. As demonstrated in a complementing study (Luger-Bazinger, Geser & Hornung-Prähauser, 2023), the development of such new behaviour change interventions can best be formulated taking to account psychological models of behaviour change to increase their effectiveness, such as the COM-B Model (Michie, van Stralen & West, 2011), along with corresponding codifications of the interventions based on an expert-agreed taxonomy of behaviour change techniques (Michie et al., 2013).

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