Developing behaviour change techniques on local online retailers to encourage sustainable cargo bike delivery

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Abstract

This study investigates the research-based development of novel behaviour change techniques (BCTs) to encourage sustainable consumer delivery choices on local online retailers. Using a webshop simulator, it will test BCTs designed for easy adoption by small businesses, aiming to promote eco-friendly last-mile delivery options and support local economic development.

Keywords

Sustainable logistics, consumer behaviour, last-mile delivery, triple transition, sustainable consumerism, e-commerce, behaviour change technique, nudging

Background

In recent times, there has been an upswing in business model innovation in both studies in practice, especially given that modifications to existing business models are generally acknowledged to realise novel innovations geared towards sustainability, i.e., sustainable business models (SBMs) (Evans et al., 2017). SBMs "describe the rationale of how an organisation creates, delivers, and captures value, in economic, social, cultural, or other contexts, in a sustainable way" (Nosratabadi et al., 2019, p. 1), where the value proposition provides quantifiable environmental or social value alongside economic value (Boons & Lüdeke-Freund, 2013). Generally, it is recognised that SBMs are a key element of cultivating a competitive advantage (Bocken et al., 2014). Nonetheless, many business model innovations still fail (Geissdoerfer et al., 2018), and thus the exact practicalities of how to successfully adopt SBMs warrant more attention (Evans et al., 2017).

Large multinational companies might be in a better position to scale sustainability efforts, and they are likely to have a major role once sustainable concepts are proven and competition pushes them to adapt. However, in the short term, it's more probable that new start-ups and smaller businesses will lead the way in pioneering bold innovations (Nerkar & Shane, 2003). In fact, a greater number of small and medium-sized enterprises (SMEs) are focusing on sustainable development and making the transition towards SBMs amidst changing market conditions, technological innovation, stakeholder influence and policy changes (Troise et al., 2024). According to Troise et al. (2024), SMEs in particular are characterised by their 'openness' to adapt to innovative approaches, which can help them adapt to everchanging market requirements as consumer needs are gradually adapted towards sustainability and firms strive to meet these expectations.

Looking particularly at the online retail environment, shopping on e-commerce sites has steadily increased (eMarketer, 2023). Without interventions, major cities could see a 36% increase in delivery vehicles by 2030 (World Economic Forum, 2020), leading to higher emissions and congestion. Furthermore, a greater number of delivery parcels has given rise to increased negative environmental externalities, namely air pollution, noise pollution, traffic congestion and greenhouse gas (GHG) emissions (Wernbacher et al., 2023). In particular, the last-mile delivery segment, which involves moving parcels from local warehouses to final destinations, accounts for a substantial portion of delivery CO_2 emissions in Europe (Higgs et al., 2022). So far, the emphasis has primarily been on supply-side solutions, such as adopting cleaner vehicles (Ignat & Chankov, 2020; Viu-Roig & Alvarez-Palau, 2020), such as e-cargo bikes. E-cargo bikes in particular offer a practical alternative to traditional and electric cars and vans, with the potential to enhance the sustainability of urban logistics, especially for last-mile deliveries (Malik et al., 2023). This is because cargo bikes are virtually noiseless, zero emissions, and are efficient to manoeuvre (Anderluh & Nolz, 2022). In recent times, the proportion of commercial delivery services via e-cargo bike has steadily increased, in line with the New EU Urban Mobility Framework,

which denotes e-cargo bikes' utility in terms of moving goods in urban areas (European Commission, 2021). Furthermore, platform-based delivery services have contributed to the growth of bicycle courier work, where the rise of on-demand delivery platforms has created new opportunities for bicycle couriers to expand their operations and meet the growing demand for sustainable last-mile deliveries (Suslowicz & Brömmelstroet, 2024). Such courier initiatives have taken form as small enterprises or community-driven cooperatives that work together with local businesses, municipalities and other courier services to effectively work towards social and environmental goals, such as FULMO Kurierunion in Leipzig, Germany (https://fulmo.cc/). In doing so, large-scale obstacles in urban logistics can be overcome by means of small-scale, local solutions.

The success of implementing new approaches that reduce environmental externalities largely rest on whether modifications to individual habits and practices can answer to the increasing number of new innovations offered (Lehner et al., 2016). Although there is progress towards the use of clean delivery vehicles, on the other side of the coin there is a growing recognition of the need for aligned demand-side approaches that motivate and encourage consumers to actively seize these environmentally friendly options (Lehner et al., 2016). Amidst a trend towards greater sustainable consumerism, a greater number of buyers are willing to offer flexibility and accept longer wait times or additional costs for greener delivery options (Seven Senders, 2022). However, retailers to date have lacked regarding equipping consumers with sustainable delivery choices (Buldeo Rai et al., 2021), which in turn "contradict the growing sustainability awareness of many end customers" (Wernbacher et al., 2023, p. 1). However, enterprises that emphasise such eco-attributes and have the potential to take advantage of this newfound consumer context and enhance their brand reputation (Becchetti et al., 2020).

Encouraging sustainable consumer delivery choices

Nudging customers towards newfound sustainable choices can possibly be a success factor for effectively leveraging more sustainable ways of doing business. In an attempt to steer and nudge consumer behaviour, interventions in the form of behaviour change techniques (BCTs) with roots in psychology and behavioural economics, defined as "observable, replicable, and irreducible components of an intervention designed to alter or redirect causal processes that regulate behaviour" (Michie et al., 2013, p. 2) have been a topic of interest. Such interventions do not restrict users from making a certain action but rather serve to subtlety guide one's behaviour (Hankammer et al., 2021). Although BCTs to date have been mainly applied within the context of health interventions, BCTs and their corresponding taxonomy are conceived to be cross-disciplinary and utilised in different application domains (Michie et al., 2013).

In fact, the use of BCTs has been increasingly employed to encourage sustainable consumerism (Carlsson et al., 2021; Evans et al., 2017; Schubert, 2016). Following the SBM archetypes by Bocken et al. (2014), the employment of consumer-facing BCTs with the purpose of transitioning consumer behaviour towards sustainable choices possesses a predominately social innovation component and can adhere to the SBM archetype *'Adopt a stewardship role'*, whose purpose is to enhance the positive societal and environmental effects of the company by promoting the long-term health and well-being of its stakeholders, including society and the environment, where companies work to support and advance the well-being of their ecosystems (Bocken et al., 2014).

Exploring the use of BCTs to motivate and persuade consumers to choose green delivery options on e-commerce sites is no exception and have already been experimented with in studies (e.g., Buldeo Rai et al., 2021; Caspersen & Navrud, 2021; Nijssen et al., 2023). However, most studies to date have only tested the same three types of BCTs. In our prior literature review, it was found that the most predominant types of BCTs tested were: (1) *Information about social and environmental consequences*, (2) *Social comparison*, and (3) *Material incentive* (Thelen et al., 2024). Furthermore, many prior studies conducted on this topic have only utilised a survey design (e.g., Ignat & Chankov, 2020; Nijssen et al., 2023; Thomas et al., 2022; Viet et al., 2023), with a dearth of the studies that employed a simulator (e.g., Nijssen et al., 2023). Utilising a stated-preference survey possibly overlooks the so-called *green gap*, known as "the discrepancy between what consumers say about their growing concern regarding the environment, on the one hand, and what they truly do to help sustain this environment" (ElHaffar et al., 2020, p. 1), as their behaviours are not quantified. Furthermore, in the context of online shopping and e-commerce, the discrepancy of consumer's green purchasing intention and behaviour has not been given enough attention (Wang et al., 2025). Testing varying BCTs in an online shopping simulator is perhaps better suited to bridge this gap than merely stated-preference surveys, as a simulated online shopping environment can more realistically mimic an actual e-commerce purchase process and perhaps better account for the situational cues and unconscious processes that are involved in the experience online shopping, such as the ones described in Papies (2017).

Current study

In order to find innovative BCTs that motivate and promote sustainable consumer delivery choices on online shops effectively, this research endeavours to go beyond existing studies by developing and incorporating novel BCT types which to our knowledge are not yet existent in the literature by: (1) offering a choice of the specific vehicle type (i.e., choosing between *"cargo bike delivery via a local courier service"* and *"standard delivery*"), (2) by utilising an experimental webshop prototype simulator which mimics a real-life shopping environment on a comparable local online retailer, and (3) by testing BCTs that can be

readily adopted by and have the highest ease of use for local small and medium-sized businesses. Considering the eventual uptake of these BCTs by online retailers, it is acknowledged that over 50% of European SMEs conduct online sales (Eurostat, 2024), and that local, small online businesses do not always possess the expertise nor capability to develop and display complex BCTs that take a lot of backend coding (e.g., displaying of precise CO_2 calculations). To maximise the uptake of such BCTs by local online retailers, future BCTs to motivate sustainable consumer delivery choices should be straightforward and able to be adopted by local online shops that possess minimal IT expertise. Employing such an inclusive approach to local online retailers can also further promote the use of sustainable local and regional supply chains. All in all, by considering the aforementioned elements, developing BCTs in such a manner has the potential to accelerate the global triple transition, a "systemic approach that places the interlinkages and interconnections of the environmental, digital, and social aspects of development at the core" (OECD Development Centre, 2023, p. 14). This is done by addressing the negative externalities brought on by e-commerce deliveries, while at the same time also nurturing sustainable local and economic development within localities.

Hence, we intend to expand our research by concentrating on the following research questions:

1. How can behaviour change techniques that motivate and incentivise online consumers to choose cargo bike delivery be most optimally developed to the benefit of local online retailers, local cargo bike couriers and users?
2. How can a field test that simulates a real-life webshop environment be best developed to capture the effectiveness of behaviour change techniques?

Methods

First, a literature review of previous relevant studies and a screening of online retailers were conducted to analyse currently implemented digital BCTs in studies and in practice and classifying them according to the Behaviour Change Technique Taxonomy of Michie et al. (2013). This was complemented by a co-creation workshop with a panel of local online consumers and several interviews with owners of local online retailers and local bicycle couriers to assess their needs and preferences concerning BCT design and implementation. After an internal design sprint, ideas for novel BCTs were developed according to the methodology of Rubinstein (2018) and ranked according to the APEASE criteria (West et al., 2019), which assesses BCTs based on their acceptability, predictability, effectiveness, affordability, side-effects and equity. Concurrently, an experimental webshop prototype simulator was developed by an e-commerce IT service provider, VIABIRDS Technologies GmbH, who took feedback into account in a stepwise manner during the stakeholder co-creation process in agile iterations. Thereafter, the final prototype simulator's usability was validated by means of two pre-tests: one internally (N = 25) and one externally (N = 110).

Thereafter, six novel behaviour change techniques for the context of the study will be implemented on the experimental webshop prototype simulator, which will be tested with prospective online shoppers based in Austria in the spring of 2025 (*N* = >1.000). The online field test in a simulated webshop environment will involve respondents undertaking a task with instructions (i.e., *"choose one or two products from the fictional store and complete the purchase as though you were making an actual purchase").* Specifically, the simulator tests prospective online consumers' choice of delivery option during the check-out phase of the customer journey, as they are confronted with two delivery options at checkout: *DHL standard delivery* or *local cargo bike courier delivery* (with the latter displaying an accompanying BCT alongside). Thereafter, a brief survey follows to gather insight on demographic and psychographic traits. Here, the total sample is assigned to one of six cases (six experimental groups with different displayed BCTs and one control group without a BCT) via random sampling. Thereafter, the sample's delivery choices will be quantitatively analysed to measure the effectiveness of the employed BCTs among different user groups.

Conclusion and preliminary results

Although still currently under way, our research employs a multifaceted approach by helping equip local online enterprises to stay competitive and market their sustainability attributes. At the same time, the use of local cargo bike courier services can be promoted, and sustainable consumerism can be nurtured by making online buyers cognisant of the eco-attributes of their delivery choices. In doing so, shorter, local supply chains are given greater attention by prioritising the needs of local online shops and the negative externalities brought on by the increased use of e-commerce can be better mitigated. By aiming to tackle such a wider, systemic issue through a lens of local, user and community-driven solutions, our research aims to scale more sustainable last-mile delivery and logistics operations that can be readily adopted by local actors. In doing so, newfound SBMs derived from SMEs that answer to contemporary social and market contexts can possibly be strengthened and better leveraged, all the while spurring local economic development.

Preliminary results point towards the general acceptance and usability of the developed BCTs and the webshop prototype simulator, which was well-received among a sample in the pre-test. Contributions towards the conference session would exhibit the prototype and delve into our systematic process of developing novel BCTs according to the aforementioned attributes that are accepted by all facets of the smart urban bicycle logistics ecosystem that take into account the needs of citizens, logistics providers and online retailers. Additionally, we will share insights into the process of systematically developing a research-based experimental webshop prototype simulator for effective field testing in an online retail environment.

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