

EXPERIMENTS IN SUSTAINABLE BUSINESS

by

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*Dedicated to my father,
Muhammad Iqbal (1959 – 2020)*

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CHAPTER I

General Introduction

The research presented in this dissertation was conducted during a time when the world was grappling with rising existential threats to mankind in the form of irreversible climate change and other environmental concerns as well as escalating local and global societal issues (von Weizsäcker, 2018; Lenton et al., 2019). While there has been some progress on several important sustainability outcomes, the challenge is still daunting and calls for all actors in society to acknowledge their shared responsibility (Elliott, 2013). Private businesses – a major societal actor – have significant direct and indirect influence on environmental and social footprints through their business activities (Amaeshi et al., 2008; Wiedmann et al., 2009). Whereas the direct influence of businesses on society and the environment is due to their core business activities (e.g., production), they also exert an indirect influence through their relationships with external stakeholders (e.g., suppliers, consumers) (Wiedmann et al., 2009). Given the significance of these impacts, a change from current unsustainable business practices toward more sustainable business practices is imperative (Bocken & Short, 2021).

The notion of sustainable business has evolved in recent decades, and the boundaries of sustainable business have expanded to encompass multiple elements and layers of business strategy and activities (Van Marrewijk & Were, 2003). The academic field of sustainable business thus encompasses such domains as the company's business model, supply chain and innovation processes, as well as sustainable consumption and sustainable finance initiatives (cf. Clark et al., 2018; Schaltegger et al., 2012; Michaelis, 2003). While acknowledging the importance of each of these domains, one could argue that to ensure a successful transformation towards sustainable business, change is necessary on at least at three levels:

- At the micro level, a change towards more *sustainable consumer behaviour* is needed, where sustainable consumer behaviour is defined as behaviour that attempts to satisfy present needs while benefiting or limiting the environmental or social impact (Trudel, 2019).

- At the meso level, organisational transformations towards more *sustainable business models* are needed, where sustainable business models are defined as business models that incorporate sustainability as a central element of a company's value proposition and value-creation logic (Abdelkafi & Täuscher, 2016; Geissdoerfer et al., 2018).
- At the macro level, there is need for change in capital markets so as to direct capital toward sustainable businesses through *sustainable finance* initiatives, where sustainable finance is defined as the management of financial resources and investments to promote enduring positive and measurable social and environmental impacts (Cunha et al., 2021).

Innovation and experimentation are required on all three levels if we are to transition successfully from unsustainable to more sustainable consumption patterns, business models and financial practices. Using experiments as my skateboard in this dissertation, I aim to investigate factors that contribute to sustainable change and transitions at these three levels.

The field of sustainable business has grown considerably in recent years, but it is still nascent in many respects. This necessitates further scientific inquiry, not least in field-based empirical settings (Preghenella & Battistella, 2021; Santa-Maria et al., 2021). On an overarching level, key questions are found at each of the three levels outlined above. First, there is a need for research on the mechanisms through which companies can successfully transform towards more *sustainable business models* in practice (Evans et al., 2017; Bocken & Antikainen, 2018). Second, we lack field-based evidence on how companies can stimulate *sustainable consumer behaviour* through various marketing innovations (Fiore et al., 2017). Third, while knowledge on *sustainable finance* behaviours is growing, we know little about the dynamics of individual retail investors' sustainable investment behaviours over time (cf. Truelove et al., 2014).

Notably, such sustainability transitions are, in practice, characterised by various drivers and barriers – organisational, institutional, structural, behavioural and so on, (Álvarez Jaramillo et al., 2019). Some of these barriers occur at the organisational level and are internal to the company (e.g., barriers to the design and implementation of sustainable business models). Others are more closely related to the company's external stakeholders, such as behavioural barriers on the individual level (e.g., ingrained consumption or investment practices).

The extant literature acknowledges such barriers to sustainability transitions. However, there are still gaps in our understanding of these barriers and ways of overcoming them in the context of companies' innovation processes, regardless of whether the focus is on product innovation,

process innovation or marketing innovation (Álvarez Jaramillo et al., 2019). For instance, we lack knowledge on how internal business experimentation processes inform and shape the design of sustainable business models in practice. What are the key drivers of and barriers to the adoption of such sustainable business models? How can they be overcome? With respect to consumer behaviour, we need more knowledge on how companies can use technology-based marketing innovations to facilitate sustainable consumption practices among consumers. What are the barriers to the adoption of such technologies and how can they be overcome? Finally, with regard to sustainable finance, we would benefit from knowledge on how behavioural factors may impede or facilitate the provision of finance to sustainable businesses in capital markets. What are the behavioural determinants of such investment choices? What are their dynamics over time?

These are some of the research gaps in the extant literature that must be addressed in order to advance our knowledge on sustainability transitions in businesses. These research problems relate to the three organisational levels discussed above. In this dissertation, I adopt an experimental approach to investigate key research questions at these three levels. The overall research statement in this dissertation is:

How can we use experiments to understand and overcome some of the drivers of and barriers to sustainable transitions for businesses in practice?

I attempt to answer this broad statement by means of four empirical studies, in which I primarily focus on drivers of and barriers to sustainable transitions and different ways to overcome these barriers. In doing so, I further aim to demonstrate how experiments can be used to drive sustainable transitions for businesses in real life.

In the light of this research statement, the company is a natural point of departure. I therefore begin my inquiry with the urgent need to design sustainable business models (Schaltegger et al., 2016a; Bocken & Short, 2021). The business model is a vital pillar for every company, and it is central to the design and architecture of key business activities (Chesbrough, 2007). The business model concept has become increasingly central in both academic discussions and business practices related to innovation (Chesbrough, 2007; Wells, 2013). Given the mounting concerns regarding environmental and societal sustainability, some scholars even argue that sustainable business models, which were previously viewed as a potential source of competitive

advantage, are likely to become essential (Geissdoerfer et al., 2018). In other words, companies are increasingly expected to integrate sustainability into their business models from the outset and incumbents operating with unsustainable business models are expected to transition towards more sustainable business models (Bocken & Short, 2021; Geissdoerfer et al., 2018).

In recent years, researchers have significantly advanced our knowledge of how to integrate sustainability into business models (e.g., Bocken et al., 2014; Boons & Lüdeke-Freund, 2013; Schaltegger et al., 2012; Stubbs & Cocklin, 2008). The focus has been on guiding businesses in developing new business models that are competitive but do not harm society or the environment (Schaltegger et al., 2016a). This requires businesses to explore the diverse ways of creating superior customer and firm value by addressing societal and environmental needs, while simultaneously investigating what works in certain situations and real-life business contexts (Boons & Lüdeke-Freund, 2013; Bocken et al., 2016; Bocken et al., 2019). To that end, the organisational capability for business model experimentation is viewed as a key aspect of the transition to sustainable business (Weissbrod & Bocken, 2017; Bocken et al., 2018). Business model experimentation occurs when businesses undertake small-scale experiments involving novel value offerings, greener production, efforts aimed at facilitating green behaviour or overall tweaks in the business model before rolling them out on a larger scale in the real world (Weissbrod & Bocken, 2017; Bocken et al., 2019). Given the uncertainty surrounding a new business model, the aim of experimentation is to innovate business models for sustainability with limited risks and resources through continuous collaboration with stakeholders (Bocken et al., 2018; Bocken et al., 2019). However, the extant literature is still lacking in insights into real-life cases of business experimentation for sustainability and the conditions under which such experimentation is successful. Thus, the research community has called for additional research that can accelerate change in both large and small industries, and among incumbents and start-ups (Bocken et al., 2016; Schaltegger et al., 2016b). I aim to help address this gap in the literature by answering the following research question:

***RQ1:** How can business model experimentation, performed in collaboration between companies and their stakeholders, inform new, sustainable business model designs?*

The business model is one piece of the sustainability transition puzzle. For sustainable business models to be successful, companies also need to succeed in encouraging and facilitating the

consumption of more sustainable products and services among their customers (Michaelis, 2003). This implies that companies need to understand the sustainability-related drivers and barriers perceived by consumers and, ultimately, consumers need to be convinced to adopt new, more sustainable solutions (Viciunaite, 2020; Viciunaite & Alfnes, 2020; Fiore et al., 2020).

Sustainable consumption is imperative for sustainable development, and companies are expected to encourage and facilitate it (Jackson, 2004; Lehner et al., 2016). The prosperity of consumers in industrialised countries, which provides them with access to a variety of goods and services, coupled with barriers at the behavioural level have been argued to systematically preclude these consumers from acting sustainably (Thøgersen, 2005; Reisch & Bietz, 2011). This suggests a need for both business interventions and policy instruments that encourage sustainable lifestyles (Thøgersen, 2005). One such intervention that is central to this dissertation is the provision of sustainability-related information to consumers. On its own, such information might be insufficient to drive behavioural change. However, miscommunication or, more generally, a lack of communication with the public about the sustainability impacts of products and services have been argued to be major barriers to the adoption of sustainable lifestyles (Reisch & Bietz, 2011). This can be addressed on a broader level through the design and promotion of environmental and social awareness, which can encourage sustainable consumption. Moreover, it can be addressed at the micro level through product-oriented interventions that communicate sustainability-related information about specific products and services (White et al., 2019).

As such, information provision can be an important lever to promote sustainable consumption (Berg, 2011; Schrader & Thøgersen, 2011). However, the limited impact of information provision on actual consumption behaviour suggests a need to find more effective avenues of influence using sustainability-related information (Vega-Zamora et al., 2019; Guillen Mandujano et al., 2021). In this technology-abundant era, often referred to as the “Fourth Industrial Revolution” (cf. Schwab, 2017), increased connectivity and smart solutions allow businesses to adopt new mobile technologies to communicate and promote sustainable products and services to consumers (Kim & Woo, 2016). However, we still lack insights into the conditions under which companies can leverage such technologies to provide consumers with sustainability-related product information in a manner that influences consumer choice. By investigating the following research question, I aim to contribute to our understanding of how companies can encourage and facilitate sustainable practices and lifestyles through the effective communication of sustainability-related product information:

RQ2: *How can businesses effectively leverage marketing innovations to communicate the sustainability-related value of their products and services in a way that encourages and facilitates sustainable consumption?*

Notably, consumption should not be understood as only isolated behaviours (Truelove et al., 2014). The extant research argues that consumer behaviour in one area often relates to other areas (Lanzini & Thøgersen, 2014; Truelove et al., 2014). That is, there are often so-called *spillover effects* between different areas of sustainable consumption. Yet, limited empirical data exists to demonstrate this phenomenon in different areas of consumption behaviour (Reisch & Bietz, 2011; Thøgersen & Crompton, 2009). The second main contribution of this dissertation relates to this gap.

Sustainable behaviour is desired in multiple facets of life from everyday consumption choices to long-term financial decisions. Hence, a large body of research focuses on interventions and policy instruments that encourage sustainable behaviour in various aspects of life (Lehner et al., 2016; Schubert, 2017; Døskeland & Pedersen, 2016; Pilaj, 2017). However, the literature on behavioural interventions aimed at encouraging sustainable behaviour usually considers behaviour in isolation and focuses on a single action, thereby disregarding its potential relation over time with past or future behaviours (Truelove et al., 2014). In contrast, recent studies argue for an interdependency of behaviours across time – often termed *behavioural spillover effects* (Truelove et al., 2014).

Although behavioural spillovers may affect the likelihood of sustainable behaviour, convincing experimental evidence on this phenomenon is scarce (Lanzini & Thøgersen, 2014; Truelove et al., 2014). In the context of capital markets, research has investigated the behavioural factors driving sustainable investment behaviour among individual retail investors (e.g., Brodback et al., 2019; Døskeland & Pedersen, 2016; Gutsche et al., 2016; Colonnello et al., 2019). However, these studies have examined pro-environmental behaviour as a static, one-shot phenomenon, in contrast to recent literature in the field of environmental psychology, which takes the dynamic nature of such behaviour into account to a greater extent. Pro-environmental behaviours can be defined as those behaviours that leave a very small footprint on the environment or even benefit the environment (Steg & Vlek, 2009). In the third main part of this dissertation, I attempt to adopt a dynamic approach to sustainability-related behaviours on the part of consumers and

investors. Thus, through the following research questions, I aim to help address this gap in the literature:

***RQ3:** How do past pro-environmental behaviours affect the likelihood of future pro-environmental behaviours in daily consumption choices?*

***RQ4:** How do expectations of future pro-environmental behaviours affect the likelihood of present pro-environmental behaviours in individuals' retail investment decisions?*

In general, the four research questions discussed above feed into the overall research statement. By answering these research questions, I aim to: (1) advance our understanding of the drivers and barriers that businesses face when trying to become more sustainable, and (2) shed light on ways of overcoming these barriers to facilitate sustainability transitions in practice (see Figure 1).

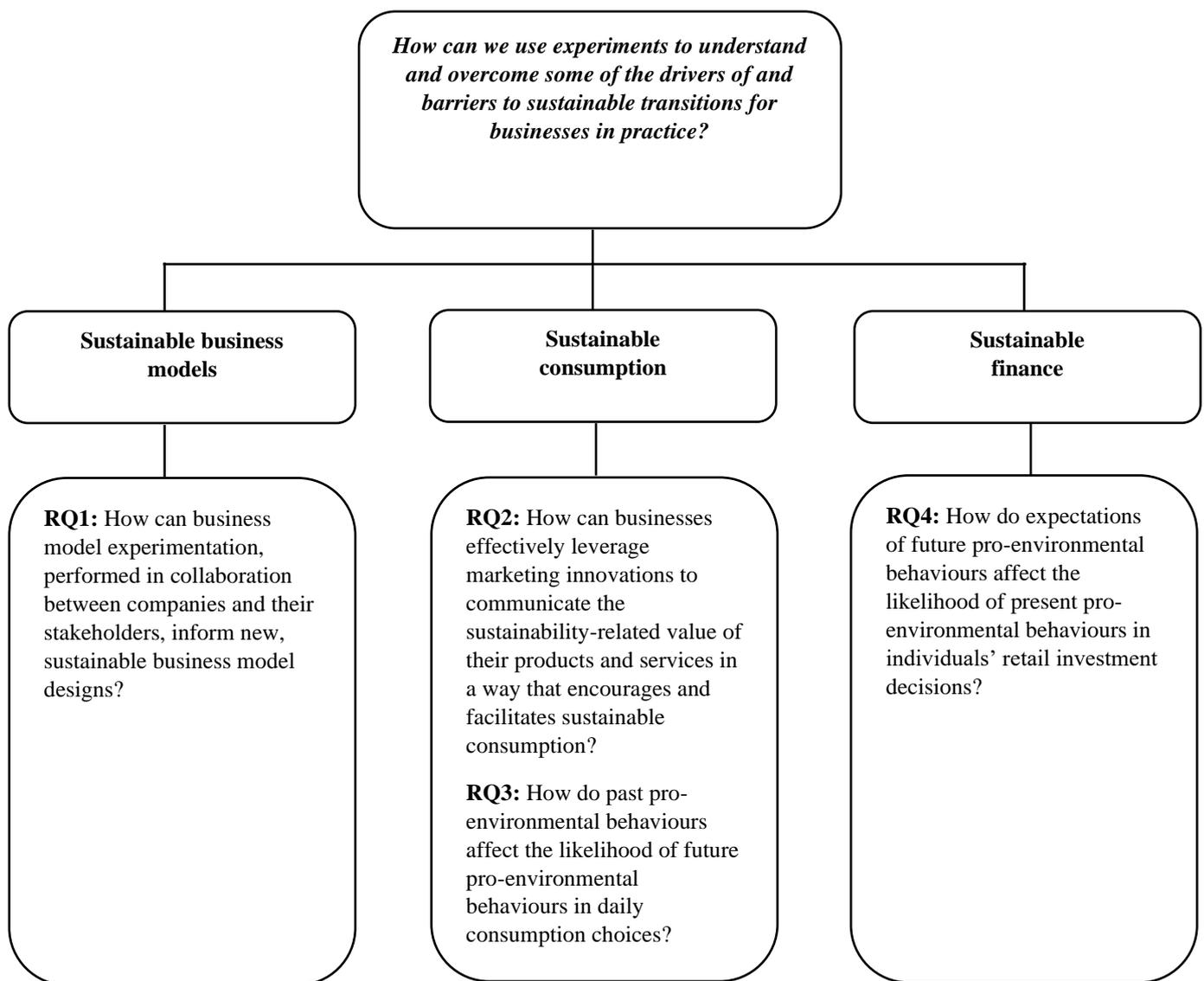


Figure 1: Overview of the research questions in each of the main areas of inquiry

This dissertation comprises four articles that aim to answer the four research questions. The title of the dissertation – *Experiments in Sustainable Business* – has a dual logic. First, from a methodological standpoint, I adopted an *experimental research approach* as the primary methodology in all four studies conducted as part of this dissertation. Experimental research is useful for establishing causal inferences by means of treatment and effect relationships (Banerjee & Duflo, 2009). I studied various behavioural and decision-making processes in multiple contexts related to sustainable business innovation. Second, from a conceptual standpoint, two of the studies in this dissertation are dedicated to studying *business experimentation for sustainability* with regard to both business model innovations and marketing innovations. Business experimentation is the process of exploring diverse ways in

which a business can create value and understanding what works in real-life business contexts (Bocken et al., 2016). The two first articles in this dissertation investigate two ongoing business-experimentation processes in a large consumer goods company. The experimentation processes relate to its business model and its market communication for sustainability, respectively. Thus, while my dissertation examines behaviour and decision-making for sustainability in general, a significant portion of my research adopts the conceptual framework of business experimentation to investigate sustainability-related innovation while using experiments as an empirical strategy (see Figure 2 for an illustration of the dual logic of experimentation in this dissertation).

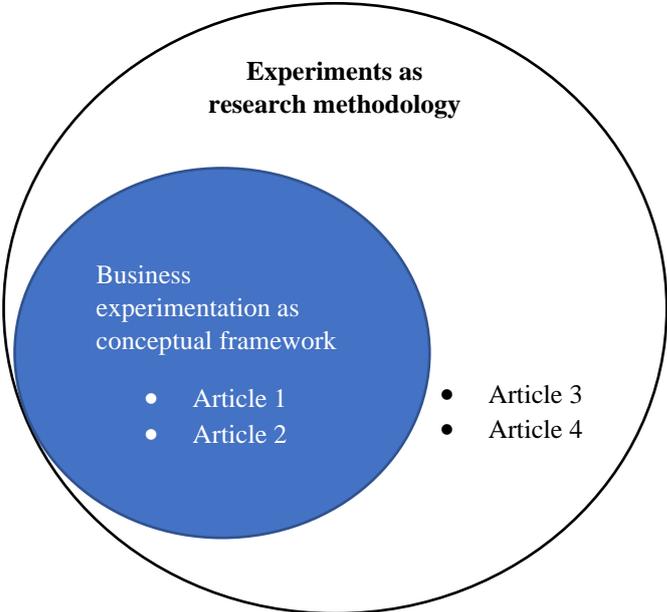


Figure 2: Dissecting the title “Experiments in Sustainable Business”

The remainder section of this introductory chapter is structured as follows. First, I briefly lay out the three main chapters of this dissertation, which investigate the four research articles that respond to each of the research questions. Second, I outline the research methodology employed throughout the four research articles. Finally, I present the main implications of the empirical studies presented in this dissertation.

BRIEF OVERVIEW OF CHAPTERS

The dissertation consists of three main chapters that investigate the research questions discussed earlier in this introduction. Chapter II focuses on the design of sustainable business models as

the vehicle through which companies can drive sustainability transitions. The chapter thus includes the research article that addresses this topic: “Experimenting with sustainable business models in fast moving consumer goods” (Bashir et al., 2020). Chapter III investigates marketing innovations focused on promoting sustainable consumption by means of information provision. It thus includes the research article that addresses this topic: “Leveraging technology to communicate sustainability-related product information: Evidence from the field” (Bashir, 2022). Chapter IV provides insights into spillovers of pro-environmental behaviours (PEBs) in everyday consumption choices as well as in sustainable investment decisions. Thus, the chapter comprises the two articles that address the two corresponding research questions: “Pro-Environmental Behavioural Spillovers” and “Pro-Environmental Behavioural Spillovers in Investment Decisions”, respectively. All of the chapters take an experimental and behavioural approach, albeit in different ways. While chapters II and III consider PEBs in isolated time settings, chapter IV investigates the effect of PEBs over time and across multiple behaviours. The remainder of this subsection further elaborates on the individual contributions of each chapter.

Chapter II

The second chapter comprises the first research article. The article is co-authored with Sveinung Jørgensen, Lars Jacob Tynes Pedersen and Siv Skard, and was published in the *Journal of Cleaner Production* in 2020. In this article, we investigate a business experimentation for sustainability (BES) process related to the business model of a fast-moving consumer goods company. There is a gap in the understanding of how business model experimentation unfolds in practice and how it can inform business model design and innovation (Evans et al., 2017) Our article aims to contribute to this gap.

Companies need to develop BES capabilities in order to transform existing business models into new, more sustainable business models (Bocken et al., 2018). This involves a reiterative process of design, experiment and analysis of different elements of the new business model until it is ready to be rolled out in the market (Bocken et al., 2019). The extant research offers insights into such BES practices in start-up businesses. However, knowledge on business model experimentation in the context of large, established businesses is scarce (Weissbrod & Bocken, 2017; Wagner & Hansen, 2005; Bocken & Antikainen, 2018). Taking a consumer-oriented approach, our research addresses this gap by investigating: (1) the drivers of and barriers to the adoption of sustainable business models, and (2) the use of experimentation to overcome these barriers and, thus, facilitate the transition to sustainable business models.

The research was conducted in collaboration with Norway's largest FMCG company, Orkla. We carried out three studies: a focus group study (n = 20), a nationally representative survey (n = 409) and a randomised survey experiment (n = 259). In the article, we employ the theory of planned behaviour (Ajzen, 1991) to investigate drivers of and barriers to consumers' adoption of green value propositions. Furthermore, we experiment with behavioural interventions that might help consumers overcome behavioural barriers to the adoption of sustainable solutions. The micro-level findings of the three studies reveal consumer barriers to the adoption of sustainability innovations. These findings are subsequently fed into the BES process of the company. In this way, we shed light on the reiterative nature of the BES process as well as how parallel and intertwined innovation and experimentation processes can inform business model transitions for sustainability.

Chapter III

The third chapter comprises the second research article, which is single-authored and was published in the *Journal of Cleaner Production* in 2022. It focuses on the role of technology in promoting sustainable products and services to consumers. Fostering sustainable consumption among customers is central for businesses in their transition toward sustainability (Lehner et al., 2016). As such, research into how various mobile technologies can be used to encourage sustainable consumption behaviour is needed (Atkinson, 2013). This chapter contributes to this gap in the literature.

Sustainability-related product information can influence consumers' willingness to adopt sustainable products or encourage sustainable consumption in general (White et al., 2019). On its own, such information may not be sufficient, but it can create an awareness of the sustainability characteristics of products and services in a manner that influences consumers' decision-making processes. Inefficient communication of sustainability-related production information from a company to its customers can thus be a barrier to sustainable consumption (Shao et al., 2016). In this regard, mobile technologies, such as QR codes, can be useful tools for engaging with customers and communicating the sustainability value of a company's products and services (Kim & Woo, 2016). However, we lack empirical insights from the field into the effectiveness of QR code technologies and the factors that influence consumers' inclination to use them (Okazaki et al., 2019). By means of an experimental research approach, I begin to address this gap in literature.

The article in this chapter is based on two studies: a nationally representative survey and a field experiment. Study 1 is an online survey (n = 250) in which I utilise the technology acceptance model (TAM) to investigate factors that influence consumers' intentions to scan QR codes to access sustainability-related product information. The findings from Study 1 inform the design of Study 2, in which I conduct a large field experiment in a retail setting (n = 157). Study 2 sheds light on the efficacy of QR codes for communicating sustainability-related product information in a real-life retail setting. Overall, the findings of the two studies advance our understanding of the role of QR codes in encouraging sustainable consumption, and how businesses can utilise such technologies in their work to facilitate more sustainable consumption.

Chapter IV

The fourth chapter comprises two research articles that investigate the dynamics of sustainability-related consumer and investment behaviours over time. Article 3 is single-authored and is an extended English version of a paper published in the Norwegian research journal *Magma* in 2021. It offers a first empirical exploration of the phenomenon of spillover effects in daily consumption decisions. This investigation feeds into the study in article 4, which offers additional empirical insights into a special case of spillover effects, often referred to as *spillunder effects* (Krpan et al., 2019). The study focuses on the context of the investment choices of individual retail investors with regard to sustainable investment. Article 4 is also single-authored.

Previous research shows that behavioural spillovers from past behaviours are likely to influence individuals' future behaviours (Truelove et al., 2014). In my research, I investigate the effects of such behavioural spillovers on sustainable consumption in consumers' daily consumption choices and their long-term investment decisions. The literature on environmental psychology suggests that the likelihood of an individual engaging in a certain pro-environmental behaviour (PEB) is likely to be influenced by a previous or expected future PEB (Truelove et al., 2014; Maki et al., 2019). These interdependencies between PEBs are referred to as *behavioural spillover effects* and *behavioural spillunder effects*, respectively (Krpan et al., 2019). Behavioural spillovers from past behaviours or from anticipated future behaviours can negatively influence the likelihood of future PEBs and, thus, hamper the adoption of sustainable products or services over time (Truelove et al., 2014). The literature has demonstrated behavioural spillovers from present behaviours (t_0) to future behaviours (t_1) in several settings (Truelove et al., 2014). However, evidence on spillunder effects – that is, the effect of expected

future behaviours (t_1) on present behaviours (t_0) (Krpan et al., 2019) – is limited. I contribute to this stream of literature by investigating behavioural spillunders in retail investors’ inclinations to invest in sustainable investment products.

In article 3, I summarise the extant knowledge and the relevance of behavioural spillovers for businesses trying to facilitate sustainable consumption. Subsequently, in article 4, I investigate behavioural spillunder effects on sustainable investment behaviour in two online experiments. The experiments examine whether individual retail investors’ inclinations to invest in sustainable investment products are influenced by their anticipation of engaging in future pro-environmental behaviours. The findings offer some, albeit limited, experimental evidence on the occurrence of spillunder effects. These indicative findings suggest a need to further investigate consumer and investment behaviours dynamically (Krpan et al., 2019).

Overall, the three chapters cover three thematic areas in sustainable business: sustainable business models, sustainable consumption and sustainable finance. The first two articles investigate consumer behaviour in isolated actions (i.e., drivers of and barriers to the adoption of sustainable business models and QR code technologies for sustainable consumption, respectively). On the other hand, articles 3 and 4 in chapter IV investigate the effects of behaviours over time (i.e., the effect of past PEBs on future PEBs and vice versa). Figure 3 illustrates the focus of each chapter.

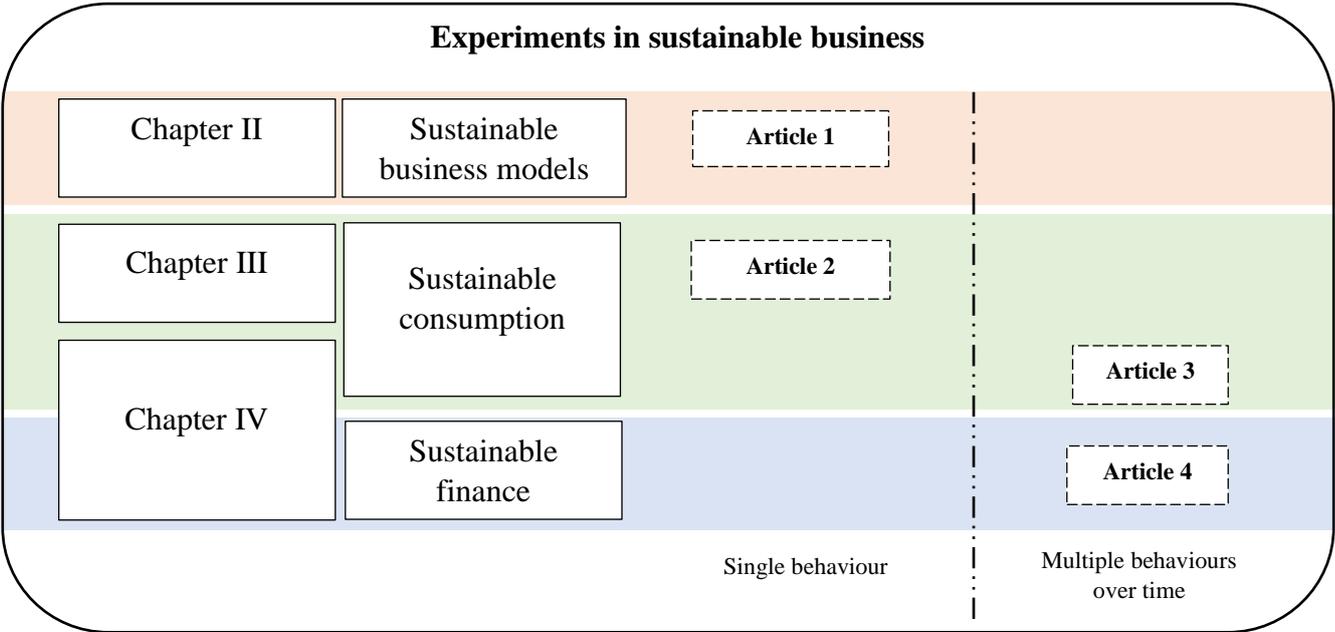


Figure 3: Overview of the chapters

RESEARCH METHODOLOGY

In my dissertation, I use a combination of online survey experiments and field experiments. Survey experiments are a variation of lab experiments that occur online. This experimental design allows researchers to record and structure data elicited from participants in response to manipulated independent variables in a controlled setting (Bloomfield et al., 2016; Harrison & List, 2004). In contrast, field experiments are conducted in real-world settings and, hence, do not provide researchers with the same degree of control over the experimental setting. However, the degree of control is still substantial, while the behavioural setting is highly realistic, as the experiment takes place in the field and records the actual behaviour of the population under investigation. The experimental designs in my dissertation that are not field-experimental and, thus, do not occur in field settings are informed by qualitative and quantitative pre-studies (e.g., focus group, surveys). In this regard, I have tried to infuse them with a contextual richness that increases their realism. In the following sub-section, I summarise the rationale for using these different types of experiments in the various empirical studies comprised in this dissertation.

The rationale for the experimental method

Experimental research is prevalent in the fields of psychology, educational science and development economics as well as some areas of business research (Ross & Morrison, 2003; Banerjee & Duflo, 2009; Zellmer-Bruhn et al., 2016). The strength of experimental research lies in its ability to identify causal relationships in complex environments by investigating and revealing treatment and effect relationships (Banerjee & Duflo, 2009). Experimental studies are based on the premise of *ceteris paribus*; that is, everything remains equal between the experimental groups except for the experimental intervention. This intervention is referred to as the “treatment” and any effect on the outcome variable can be attributed to a treatment effect, thereby ruling out any systematic error (Ross & Morrison, 2003).

My research aims to contribute to the empirical literature on sustainable business. In broad conceptual terms, empirical literature seeks to achieve five main objectives: specification of causal relationships among constructs, documentation of associations among observable variables that capture the constructs, attribution of association to the causal factors, generalisation and contextualisation of results, and the uncovering of additional opportunities for theory building (Bloomfield et al., 2016). In this regard, experiments are viewed as useful for making strong attributions about causal relationships within a theory (Zellmer-Bruhn et al., 2016). Lab experiments allow researchers to create an experimental task that mimics key

features of real-world settings and to investigate how manipulating the features of that setting affects participants' decisions (Bloomfield et al., 2016). Therefore, lab experiments are well suited for making strong attributions about causal relations (e.g., a change in variable *X* produces a directional change in variable *Y*).

A general shortcoming of lab experiments relates to their external validity in real-life settings. One concern often raised about lab experiments is that although the high level of experimental control decreases the systematic risk of confounding variables and increases the likelihood of replicable results, there is uncertainty about whether behaviours in the experiment are representative of actual behaviours (Gneezy & Imas, 2017). When participants act outside a natural setting, one can always question whether their decisions or behaviours properly represent their actual behaviours in the field (Gneezy & Imas, 2017). Moreover, some have argued that participants in a lab experiment usually represent a very specific minority of the population that is affluent, educated and industrialised (Henrich et al., 2010). Thus, one can also question whether such participants adequately represent the total population in the outcomes of the experiment.

I tried to address this limitation of lab experiments by combining them with field experiments, where possible, in my research. The strength of field experiments lies in their real-life settings, which provide the researcher with insights into the real-life behaviour of the participants and the actual effect of the treatment variable (Floyd & List, 2016). This combination of realism and control is the key benefit of “natural field experiments” – that is, experiments in which the environment is one in which the subjects, who do not know they are part of an experiment, naturally undertake the behaviour under investigation (Harrison & List, 2004). Hence, the external validity of such experiments is generally high (Gneezy & Imas, 2017).

INTENDED CONTRIBUTIONS OF THE DISSERTATION

The research presented in this dissertation aims to contribute insights relevant for both academics and practitioners. In the context of the uncertainty and risk associated with transforming businesses into becoming more sustainable, knowledge that advances our understanding of such transitions is key (Brillinger et al., 2020; Laukkanen & Patala, 2014). Taken together, the articles presented in this dissertation answer the call for testing drivers of and barriers to sustainability transitions, using experiments as the empirical strategy (Dentchev et al., 2018). Specifically, the articles respond to calls for research on experimentation with

more sustainable business models (Evans et al., 2017), the use of innovative technologies in sustainability communication to encourage sustainable lifestyles (Vega-Zamora et al., 2019), and sustainable finance initiatives aimed at encouraging individual retail investors to engage in sustainable investment (Clark et al., 2018). The remainder of this sub-section highlights the contributions of each article.

In the first article, we investigate a BES process in a large consumer goods company. Our study shows the interconnectedness of the innovation and experimentation processes, and has implications for companies that wish to experiment with and innovate for sustainability in consumer goods markets and beyond. The findings offer insights into the drivers of and barriers to the adoption of sustainable business models. The article advances our knowledge on consumers' responses to green value propositions and sustainable product-service solutions. It also contributes to the literature by providing insights into how BES informs business decisions in the transition to more sustainable business models. For managers and policy makers, the article's findings demonstrate that, in certain innovation cases, consumers may not be ready for new, green value propositions. However, the barriers to consumer acceptance can be overcome through behavioural interventions that address consumers' apprehensions.

The second article contributes to our understanding of the role of technology in facilitating sustainable consumption. In this regard, it advances the extant knowledge on the use of QR codes to communicate sustainability-related product information. The article offers insights into factors that influence consumers' intentions to scan QR codes. The findings show that companies can effectively communicate sustainability-related product information using QR codes by highlighting the sustainability characteristics of the QR codes through contextual information, placement and environmental cues. The extant literature lacks evidence on actual scanning behaviour by consumers in real-life settings and the article offers field-based insights into this behaviour and its determinants (Okazaki et al., 2019).

The third and fourth articles of the dissertation investigate pro-environmental consumer behaviour over time and across different contexts. The findings of the third article provide some evidence of *consistency effects* between PEBs in daily consumption choices. However, the findings of the fourth article offer only limited evidence of spillover effects in individual investment behaviour related to sustainable investment choices. Thus, the two articles, with some empirical evidence, further our understanding of PEB spillover and spillover effects in both consumption and investment choices (Truelove et al., 2014; Maki et al., 2019). To the extent that such effects occur in the context of PEBs, it is important to take the overall effect of

business and policy interventions into account (Tiefenbeck et al., 2013). A key takeaway from these two articles is that pro-environmental policy interventions should consider potential spillover and spillunder effects to ensure overarching positive effects on sustainable behaviour.

Taken together, the four research articles included in this dissertation further our understanding of key questions in the domains of sustainable business models, sustainable consumption and sustainable finance. In the following chapters, these research articles are presented, before I discuss their implications and avenues for further research in Chapter V.

REFERENCES

- Abdelkafi, N., & Täuscher, K. (2016). Business models for sustainability from a system dynamics perspective. *Organization & Environment*, 29(1), 74-96.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Álvarez Jaramillo, J., Zарtha Sossa, J. W., & Orozco Mendoza, G. L. (2019). Barriers to sustainability for small and medium enterprises in the framework of sustainable development— Literature review. *Business Strategy and the Environment*, 28(4), 512-524.
- Amaeshi, K. M., Osuji, O. K., & Nnodim, P. (2008). Corporate social responsibility in supply chains of global brands: A boundaryless responsibility? Clarifications, exceptions and implications. *Journal of Business Ethics*, 81(1), 223-234.
- Atkinson, L. (2013). Smart shoppers? Using QR codes and ‘green’ smartphone apps to mobilize sustainable consumption in the retail environment. *International Journal of Consumer Studies*, 37(4), 387-393.
- Banerjee, A. V., & Duflo, E. (2009). The experimental approach to development economics. *Annual Review of Economics*, 1(1), 151-178.
- Bashir, H. (2022). Leveraging technology to communicate sustainability-related product information: Evidence from the field. *Journal of Cleaner Production*, 362, 132508.
- Bashir, H., Jørgensen, S., Pedersen, L. J. T., & Skard, S. (2020). Experimenting with sustainable business models in fast moving consumer goods. *Journal of Cleaner Production*, 270, 122302.
- Berg, A. (2011). Not roadmaps but toolboxes: Analysing pioneering national programmes for sustainable consumption and production. *Journal of Consumer Policy*, 34(1), 9-23.
- Bloomfield, R., Nelson, M. W., & Soltes, E. (2016). Gathering data for archival, field, survey, and experimental accounting research. *Journal of Accounting Research*, 54(2), 341-395.
- Bocken, N. M., & Antikainen, M. (2018, June). Circular business model experimentation: concept and approaches. In *International Conference on Sustainable Design and Manufacturing* (pp. 239-250). Springer, Cham.

- Bocken, N., Boons, F., & Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. *Journal of Cleaner Production*, 208, 1498-1512.
- Bocken, N. M., Schuit, C. S., & Kraaijenhagen, C. (2018). Experimenting with a circular business model: Lessons from eight cases. *Environmental Innovation and Societal Transitions*, 28, 79-95.
- Bocken, N. M., & Short, S. W. (2021). Unsustainable business models—Recognising and resolving institutionalised social and environmental harm. *Journal of Cleaner Production*, 312, 127828.
- Bocken, N. M., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65, 42-56.
- Bocken, N. M., Weissbrod, I., & Tennant, M. (2016, April). Business model experimentation for sustainability. In *International Conference on Sustainable Design and Manufacturing* (pp. 297-306). Springer, Cham.
- Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, 45, 9-19.
- Brillinger, A. S., Els, C., Schäfer, B., & Bender, B. (2020). Business model risk and uncertainty factors: Toward building and maintaining profitable and sustainable business models. *Business Horizons*, 63(1), 121-130.
- Brodback, D., Guenster, N., & Mezger, D. (2019). Altruism and egoism in investment decisions. *Review of Financial Economics*, 37(1), 118-148.
- Chesbrough, H. (2007). Business model innovation: it's not just about technology anymore. *Strategy & Leadership*, 35(6), 12-17.
- Clark, R., Reed, J., & Sunderland, T. (2018). Bridging funding gaps for climate and sustainable development: Pitfalls, progress and potential of private finance. *Land Use Policy*, 71, 335-346.
- Colonnello, S., Curatola, G., & Gioffré, A. (2019). Pricing sin stocks: Ethical preference vs. risk aversion. *European Economic Review*, 118, 69-100.
- Cunha, F. A. F. D. S., Meira, E., & Orsato, R. J. (2021). Sustainable finance and investment: Review and research agenda. *Business Strategy and the Environment*, 30(8), 3821-3838.

- Dentchev, N., Rauter, R., Jóhannsdóttir, L., Snihur, Y., Rosano, M., Baumgartner, R., ... & Jonker, J. (2018). Embracing the variety of sustainable business models: A prolific field of research and a future research agenda. *Journal of Cleaner Production*, 194, 695-703.
- Døskeland, T., & Pedersen, L. J. T. (2016). Investing with brain or heart? A field experiment on responsible investment. *Management Science*, 62(6), 1632-1644.
- Elliott, J. A. 2013. *An Introduction to Sustainable Development*. 4th ed. Routledge, London.
- Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., & Barlow, C. Y. (2017). Business model innovation for sustainability: Towards a unified perspective for creation of sustainable business models. *Business Strategy and the Environment*, 26(5), 597-608.
- Fiore, M., Galati, A., Gołębiewski, J., & Drejerska, N. (2020). Stakeholders' involvement in establishing sustainable business models: The case of Polish dairy cooperatives. *British Food Journal*, 122(5), 1671-1691.
- Fiore, M., Silvestri, R., Contò, F., & Pellegrini, G. (2017). Understanding the relationship between green approach and marketing innovations tools in the wine sector. *Journal of Cleaner Production*, 142, 4085-4091.
- Floyd, E., & List, J. A. (2016). Using field experiments in accounting and finance. *Journal of Accounting Research*, 54(2), 437-475.
- Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. *Journal of Cleaner Production*, 198, 401-416.
- Gneezy, U., & Imas, A. (2017). Lab in the field: Measuring preferences in the wild. *In Handbook of Economic Field Experiments* (Vol. 1, pp. 439-464). North-Holland.
- Guillen Mandujano, G., Vergragt, P., & Fischer, D. (2021). Communicating sustainable consumption. *The Sustainability Communication Reader: A Reflective Compendium*, 263-279.
- Gutsche, G., Köbrich-León, A., & Ziegler, A. (2016). *On the relevance of psychological motives, values, and norms for socially responsible investments: An econometric analysis* (No. 41-2016). MAGKS Joint Discussion Paper Series in Economics.
- Harrison, G. W., & List, J. A. (2004). Field experiments. *Journal of Economic Literature*, 42(4), 1009-1055.

- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world?. *Behavioral and Brain Sciences*, *33*(2-3), 61-83.
- Jackson, T. (2004). Negotiating Sustainable Consumption: A review of the consumption debate and its policy implications. *Energy & Environment*, *15*(6), 1027-1051.
- Kim, Y. G., & Woo, E. (2016). Consumer acceptance of a quick response (QR) code for the food traceability system: Application of an extended technology acceptance model (TAM). *Food Research International*, *85*, 266-272.
- Krpan, D., Galizzi, M. M., & Dolan, P. (2019). Looking at Spillovers in the Mirror: Making a Case for “Behavioral Spillunders”. *Frontiers in Psychology*, *10*, 1142.
- Lanzini, P., & Thøgersen, J. (2014). Behavioural spillover in the environmental domain: an intervention study. *Journal of Environmental Psychology*, *40*, 381-390.
- Laukkanen, M., & Patala, S. (2014). Analysing barriers to sustainable business model innovations: Innovation systems approach. *International Journal of Innovation Management*, *18*(06), 1440010.
- Lehner, M., Mont, O., & Heiskanen, E. (2016). Nudging—A promising tool for sustainable consumption behaviour?. *Journal of Cleaner Production*, *134*, 166-177.
- Lenton, T. M., Rockström, J., Gaffney, O., Rahmstorf, S., Richardson, K., Steffen, W., & Schellnhuber, H. J. (2019). Climate tipping points—too risky to bet against. *Nature*, *575*, 592-595.
- Maki, A., Carrico, A. R., Raimi, K. T., Truelove, H. B., Araujo, B., & Yeung, K. L. (2019). Meta-analysis of pro-environmental behaviour spillover. *Nature Sustainability*, *2*(4), 307-315.
- Michaelis, L. (2003). The role of business in sustainable consumption. *Journal of Cleaner Production*, *11*(8), 915-921.
- Okazaki, S., Navarro, A., Mukherji, P., & Plangger, K. (2019). The curious versus the overwhelmed: Factors influencing QR codes scan intention. *Journal of Business Research*, *99*, 498-506.
- Pilaj, H. (2017). The choice architecture of sustainable and responsible investment: Nudging investors toward ethical decision-making. *Journal of Business Ethics*, *140*(4), 743-753.

- Preghenella, N., & Battistella, C. (2021). Exploring business models for sustainability: A bibliographic investigation of the literature and future research directions. *Business Strategy and the Environment*, 30(5), 2505-2522.
- Reisch, L. A., & Bietz, S. (2011). Communicating sustainable consumption. In *Sustainability Communication* (pp. 141-150). Springer, Dordrecht.
- Ross, SM. & Morrison, G.R. (2003) Experimental research methods. Ch 38 in David H. Jonassen (ed.), *Handbook of Research for Educational Communications and Technology*. New York: Macmillan.
- Santa-Maria, T., Vermeulen, W. J., & Baumgartner, R. J. (2021). Framing and assessing the emergent field of business model innovation for the circular economy: A combined literature review and multiple case study approach. *Sustainable Production and Consumption*, 26, 872-891.
- Schaltegger, S., Hansen, E. G., & Lüdeke-Freund, F. (2016a). Business models for sustainability: Origins, present research, and future avenues. *Organization & Environment*, 29(1), 3-10.
- Schaltegger, S., Lüdeke-Freund, F., & Hansen, E. G. (2012). Business cases for sustainability: the role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, 6(2), 95-119.
- Schaltegger, S., Lüdeke-Freund, F., & Hansen, E. G. (2016b). Business models for sustainability: A co-evolutionary analysis of sustainable entrepreneurship, innovation, and transformation. *Organization & Environment*, 29(3), 264-289.
- Schrader, U., & Thøgersen, J. (2011). Putting sustainable consumption into practice. *Journal of Consumer Policy*, 34(1), 3-8.
- Schubert, C. (2017). Green nudges: Do they work? Are they ethical?. *Ecological Economics*, 132, 329-342.
- Schwab, K. (2017). *The fourth industrial revolution*. Redfern, Sydney: Currency.
- Shao, J., Taisch, M., & Ortega-Mier, M. (2016). A grey-DEcision-MAking Trial and Evaluation Laboratory (DEMATEL) analysis on the barriers between environmentally friendly products and consumers: practitioners' viewpoints on the European automobile industry. *Journal of Cleaner Production*, 112, 3185-3194.

- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309-317.
- Stubbs, W., & Cocklin, C. (2008). Conceptualizing a “sustainability business model”. *Organization & Environment, 21*(2), 103-127.
- Thøgersen, J. (2005). How may consumer policy empower consumers for sustainable lifestyles?. *Journal of Consumer Policy, 28*(2), 143-177.
- Thøgersen, J., & Crompton, T. (2009). Simple and painless? The limitations of spillover in environmental campaigning. *Journal of Consumer Policy, 32*(2), 141-163.
- Tiefenbeck, V., Staake, T., Roth, K., & Sachs, O. (2013). For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign. *Energy Policy, 57*, 160-171.
- Trudel, R. (2019). Sustainable consumer behavior. *Consumer Psychology Review, 2*(1), 85-96.
- Truelove, H. B., Carrico, A. R., Weber, E. U., Raimi, K. T., & Vandenberg, M. P. (2014). Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework. *Global Environmental Change, 29*, 127-138.
- Van Marrewijk, M., & Werre, M. (2003). Multiple levels of corporate sustainability. *Journal of Business ethics, 44*(2), 107-119.
- Vega-Zamora, M., Torres-Ruiz, F. J., & Parras-Rosa, M. (2019). Towards sustainable consumption: Keys to communication for improving trust in organic foods. *Journal of Cleaner Production, 216*, 511-519.
- Viciunaite, V. (2020). Communicating sustainable business models to consumers: A translation theory perspective. *Organization & Environment, 1086026620953448*.
- Viciunaite, V., & Alfnes, F. (2020). Informing sustainable business models with a consumer preference perspective. *Journal of Cleaner Production, 242*, 118417.
- Von Weizsäcker, E. U., & Wijkman, A. (2018). *Come on!*. Berlin, Germany: Springer.
- Wagner, E. R., & Hansen, E. N. (2005). Innovation in large versus small companies: insights from the US wood products industry. *Management Decision, 43*(6), 837-850.

Weissbrod, I., & Bocken, N. M. (2017). Developing sustainable business experimentation capability—A case study. *Journal of Cleaner Production*, *142*, 2663-2676.

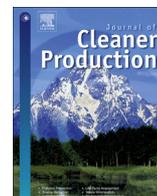
Wells, P. E. (2013). *Business models for sustainability*. Edward Elgar Publishing.

White, K., Habib, R., & Hardisty, D. J. (2019). How to SHIFT consumer behaviors to be more sustainable: A literature review and guiding framework. *Journal of Marketing*, *83*(3), 22-49.

Wiedmann, T. O., Lenzen, M., & Barrett, J. R. (2009). Companies on the scale: Comparing and benchmarking the sustainability performance of businesses. *Journal of Industrial Ecology*, *13*(3), 361-383.

Zellmer-Bruhn, M., Caligiuri, P., & Thomas, D. C. (2016). From the editors: Experimental designs in international business research. *Journal of International Business Studies*, *47*(4), 399-407.

CHAPTER II



Experimenting with sustainable business models in fast moving consumer goods



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ABSTRACT

The transition to more sustainable business requires comprehensive transformations of business models, and such innovation can benefit from business experimentation for sustainability (BES). In this paper, we investigate BES in fast-moving consumer goods (FMCG). The aim of our study is to investigate how a reiterative BES process can inform the design of more sustainable business models. Specifically, we experiment with greener value propositions, to reveal relevant barriers and strategic interventions to overcome them. In three interrelated studies conducted in collaboration with Norway's largest FMCG company Orkla, we investigate a BES process on refill-based business models for cleaning products, which are aimed at plastic reduction. We investigate consumer acceptance of such sustainable solutions in a focus group (study 1), drivers and barriers associated with the adoption of these solutions in a large-scale survey (study 2), and interventions aimed at overcoming relevant barriers for adoption in an online survey experiment (study 3). Our findings shed light on how BES can reveal actionable insights for business model innovation, related to (1) systematic barriers that need to be overcome to stimulate the adoption of more sustainable solutions, and (2) to behavioural interventions that can facilitate green consumption. Our empirical investigation thus contributes to the understanding of how reiterative BES can drive the transition to more sustainable business models.

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1. Introduction

Consumer goods have considerable societal and environmental footprints (Bocken and Allwood, 2012), and there is increased pressure on fast-moving consumer goods (FMCG) companies to design more sustainable business models (Ashford and Hall, 2011; De Medeiros, Ribeiro and Cortimiglia, 2014). Such innovation can take the form of greener products and packaging, new modes of consumption through service-based models, changes in sourcing and logistics, and so on (e.g. Bocken et al., 2014; Boons and Lüdeke-Freund, 2013). Since consumer decisions in FMCG are largely habitual and difficult to change (Verplanken and Wood, 2006), a key challenge is to design business models that facilitate consumer adoption of new sustainable solutions (Lehner et al., 2016).

In order to enable such sustainability transitions, companies will increasingly need to develop capabilities for *business experimentation for sustainability (BES)* (Bocken et al., 2019). BES can help companies investigate which business model designs may be

successful in real-life business contexts (Bocken et al., 2018). BES practices include smaller-scale experiments on novel value offerings, greener production, and efforts to facilitate green behaviour (e.g. Weissbrod and Bocken, 2017). This can include “softer” forms of data, such as qualitative interviews and small-scale pilots, as well as “harder” forms, such as A/B tests and field experiments (cf. Bocken et al., 2019). Such practices can reveal consumer barriers to adopt green value propositions and business model designs that help consumers overcome such barriers. Existing knowledge on BES is still scarce, and as pointed out by Evans et al. (2017, p. 603), there is need for research on “ways in which companies can easily experiment with business models.” The present paper aims to address this gap by offering empirical investigation of value proposition experimentation as part of BES processes.

In this paper, we investigate a BES process in collaboration with Norway's largest FMCG company Orkla, which aimed to design business models with lower plastic footprint. The aim of our study is to investigate how a reiterative BES process can inform the design of more sustainable business models. Specifically, we experiment with greener value propositions to reveal relevant barriers and strategic interventions to overcome them. Our BES case revolves

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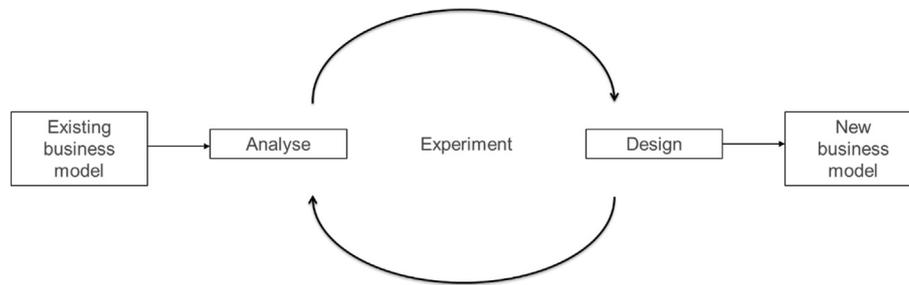


Fig. 1. The business experimentation process (based on Bocken et al., 2019).

around prospective refill-based concepts developed for cleaning products. The baseline against which the prospective solutions are contrasted is a FMCG retail model that involves selling large amounts of consumer goods in single-use plastic containers.

We conduct three studies: a focus group study ($n = 20$), a nationally representative survey ($n = 409$), and a randomised survey experiment ($n = 259$). In each iteration of the BES, our findings were seen in tandem with insights from ongoing innovation processes in the company. Our study contributes to the understanding of how BES can be used to reveal barriers for consumer adoption, and on behavioural interventions to overcome them. Furthermore, the paper provides insight into how BES informs sustainable business model innovation. Finally, our study demonstrates the potential for BES collaboration between companies and researchers.

The remainder of the paper proceeds as follows. First, we discuss experimentation for sustainable business. Second, we outline the background of our BES investigation. Third, we present studies 1–3. Finally, we discuss the findings and outline theoretical and practical implications.

2. Experimentation for sustainable business

We take as point of departure the role of BES in designing business models for sustainability transitions (cf. Schaltegger et al., 2012). A business model is a “representation of the value proposition, value creation and delivery, and value capture elements and the interactions between these elements within an organizational unit” (Geissdoerfer et al., 2016, p. 1218). We focus on value propositions, i.e. the description of the value offered to the consumer in comparison to other offerings in the market (Bocken et al., 2018).

When we refer to sustainable business models, we conceive of business models that “incorporate sustainability as an integral part of the company’s value proposition and value creation logic” (Abdelkafi and Täuscher, 2016, p. 75; Geissdoerfer et al., 2018). A broad discourse on business model innovation has evolved in recent years (e.g. Chesbrough and Rosenbloom, 2002; Chesbrough, 2007, 2010; Teece, 2010). Previous studies emphasise that business model innovation for sustainability is characterised by uncertainty and ambiguity (Roome and Louche, 2016; Andries et al., 2013). Its success factors are hard to predict (McGrath, 2010), but business model experimentation can be highly important to increase the likelihood of successful implementation (McGrath, 2010). Therefore, authors have called for further research into methods such as experimentation for sustainability (e.g. Evans et al., 2017), and BES can particularly be suitable for testing consumer receptiveness to greener solutions (Thomke and Manzi, 2014).

We conceptualise our investigation in light of the BES framework introduced by Bocken et al. (2019) (see Fig. 1). It illustrates the BES process from the current to the new business model, and how reiterative experimentation, analysis and design drives this transition by generating insights and challenges with new solutions,

and how they can be overcome. In our study, the company’s innovation processes, and our three empirical studies were intertwined in such a reiterative process of design, experimentation and analysis of the company’s new solutions.

Our paper responds to calls for research on BES. Bocken et al. (2018) revealed characteristics of the process of BES but called for research on the integration of sustainability-related and more traditional business-oriented goals. Weissbrod and Bocken (2017) demonstrated that BES approaches commonly used in start-ups can be applicable to large firms, given adequate modifications. However, they emphasised the differences between large firms and start-ups, and the need for more research on experimentation challenges and on company-researcher collaborations. Experimentation is just as relevant for large firms that aim to transit to sustainable business models; however, their process of experimentation can be different, due to differences in financial capability, resources, level of bureaucracy and so on (Wagner and Hansen, 2005). Similarly, in a paper outlining a stepwise approach to BES for circularity, Bocken and Antikainen (2018) called for research on the design, implementation and evaluation of the business model experiments in large firms. Our study addresses these gaps in the literature.

3. Background, setting and method

Our empirical setting is a BES process for new business models that involve plastic reduction in Orkla Home & Personal Care, which is a traditional FMCG company. The setting of Norway is reasonably representative of industrialized economies, but Norway is a high-income country with a well-developed take-back and recycling system for plastic.

When we became involved, Orkla had developed several business model scenarios for plastic reduction. This was based on its sustainability strategy, in which plastic pollution was identified as a highly material sustainability issue.¹ Our role as researchers involved contributing to Orkla’s innovation processes and business experimentation. This included providing ideas, engaging in dialogue with the managers, translating their questions into testable hypotheses, and designing business experiments.

The business model scenarios were the starting point for the BES process. They represented prospective solutions with varying value propositions (product vs service solutions) and value delivery designs (distribution channels, and so on). We took part in selecting five solutions from a shortlist of ten, which are the basis for the empirical investigation in this paper. The five models comprise: (1) a big-bag in the household that allows for refilling plastic containers; (2) a refill station in the store that requires that consumers bring back empty containers; (3) a home delivery solution with

¹ Our study is part of a larger research project on experimentation for sustainability, in which Orkla is a partner.

refill at home, bundled with online delivery of groceries; (4) a home delivery solution of refill based on smart-lock solutions that allows for delivery when the consumer is not at home; and (5) a home cleaning service with refill in the home included (see Fig. 2). There are thus solutions where the consumer carries out the effort and those where the service provider carries out the refill.

Since our empirical investigation is part of the company's BES efforts, our paper simultaneously reports on and influenced the experimentation process. Our three studies were designed at the outset but updated reiteratively as the BES process unfolded. The three BES stages in our empirical studies relate to similar stages in Orkla's own innovation process, which included workshops on value proposition design (cf. Fig. 1). Thus, our study reflects the potential for a cross-sector collaboration between companies and business schools on BES design and implementation (e.g. Nambisan, 2009).

4. Study 1

4.1. Aim

The aim of the first study was to explore consumer perceptions of various refill-based solutions, in order to reveal perceptions, drivers and barriers of green consumer behaviour. This study reflects the early-stage BES of Orkla, and consequently had a largely explorative design.

4.2. Conceptual framework

Several factors influence consumers' attitudes and beliefs

towards green consumption, which in turn influence intentions and behaviours (Ajzen, 1991). A combination of endogenous, exogenous and structural factors has been found to impact green consumption (Sachdeva et al., 2015). Such behaviour is shaped by consumers' attitudes, values and beliefs about green consumption (endogenous) and by influence from norms, peers and cultural frameworks (exogenous). The latter category includes various forms of norm-based influences (Sachdeva et al., 2015). Moreover, it is shaped by characteristics of the decision environment, such as choice architectures and incentive structures (structural). Understanding consumption practices, and how they may be changed in a greener direction, requires insight into these underlying characteristics.

While such characteristics are relevant across categories, which specific barriers and drivers are relevant in the case of green alternatives to low-involvement FMCG is an empirical question. It is therefore valuable to investigate the endogenous, exogenous and structural factors shaping such consumption behaviour, from the point of view of consumers themselves.

4.3. Method

We used a qualitative approach for understanding consumer perceptions, beliefs and attitudes. By perceptions, we mean consumers' preconceived ideas of product properties (Schifferstein, 2001), whereas the concept of beliefs and attitudes are borrowed from the framework of the theory of planned behaviour (Ajzen, 1991). They are measured qualitatively in study 1 and quantitatively in study 2 and 3 (cf. Tables 1 and 5).

We conducted four focus groups in the spring of 2018. Focus

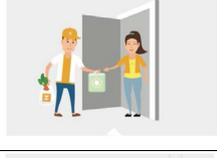
Illustration	Solution	Description
	Big-bag refill at home	The consumer refills products at home from a bigger-sized container bought in the store.
	Refill station in the store	The consumer refills products in a vending machine in the store.
	Home delivery of refill – smart lock service	Orkla provides home delivery of refills in the customers' home, by accessing it through a smart lock (e.g. Amazon Key or comparable solution).
	Home delivery of refill – grocery at the doorstep	Orkla provides home delivery of refills by "piggybacking" on home delivery providers of groceries.
	Home delivery of refill bundled with cleaning service	Orkla provides refill cleaning services bundled with cleaning services offered by a third-party supplier.

Fig. 2. Descriptions of the five business model scenarios on which the BES process was built.

Table 1
Items in the survey instrument in study 2.

Construct	Variable	Description	References
Behavioural Intention	Attitude	To what extent do you think this solution is a good idea	Taylor & Todd (1995)
	Intention to purchase	To what extent are you likely to consume this solution if/when it becomes available	
Perceived Advantages	Expensiveness	How expensive do you think this solution is compared to the other solutions?	(Claudy et al., 2015; Jansson, 2011)
	Environmental friendliness	How environmentally friendly do you think this solution is compared to the other solutions?	
	Overall perceived advantage	To what extent do you perceive this solution as advantageous to use compared to existing products.	
Perceived Risks	Convenience	To what extent would buying this solution require extra effort from you	(Claudy et al., 2015; Featherman and Pavlou, 2003; Meuter et al., 2005; Moore and Benbasat, 1991)
	Privacy risk	To what extent does this solution pose a privacy risk to you or your household	
	Functionality risk	To what extent do you perceive this solution to be easy to use	
	Product safety risk	To what extent do you perceive this solution as safe and secure for your household?	
Personal Norm	Willingness to change	To what extent are you willing to change your consumption habits to protect the environment?	(Paul et al., 2016; White et al., 2009)
	Environmental consciousness	To what extent do you have a guilty conscience for using disposable plastic?	
Normative Influence		To what extent have your closest acquaintances changed their consumption habits to protect the environment?	(Paul et al., 2016; White et al., 2009)

groups allow for data collection through group interaction on a pre-determined topic and for identifying perspectives that can be explored in more depth (Stewart and Shamdasani, 2014). They were conducted by two research team members.²

The study was composed of four groups, each including five people from the same segment, relatively balanced on age, gender and education. Four segments were included: young female adults (aged 22–23), young male adults (aged 25–27), adults with children living at home (aged 30–45) and middle-aged and elderly female adults (aged 57–75). The selection criterion was that the person was mainly in charge of shopping in the household, which explains the all-female group in the group of elderly consumers. The slight age discrepancy between genders among young adults was due to the women being bachelor students and the men master students.

The participants were presented with four of the five prospective solutions of Orkla's cleaning product outlined above (see Fig. 2). The solution based on home services with refill was omitted for the purposes of simplification, as the company did not consider it a potential solution at the time.

4.4. Findings

Participants viewed cleaning products as low involvement products, and none of the solutions were favourably perceived. In different ways, the solutions were viewed as burdensome, without significant upside. All the respondents were price-sensitive, except the adults with children, who stated a willingness to select slightly more expensive solutions if they were more sustainable. The big-bag solution was viewed as requiring greater time and effort. Refill stations in the store were viewed as inconvenient and requiring excessive effort. Functionality was also highlighted by the participants. The concerns depended on the solution: for instance,

participants believed that refill in the store would be particularly inconvenient due to the considerable change in habits. Participants were sceptical to letting someone access their home to conduct refills, especially elderly participants.

Overall, study 1 revealed that price, convenience and functionality were important characteristics (cf. Rishi, 2013). Considering the factors described by Sachdeva et al. (2015), consumers showed awareness of the plastic problem but believed that disposable plastic is sufficiently handled in Norway (endogenous factors). There were also structural barriers regarding beliefs about convenience, safety and privacy. Exogenous factors such as social norms for living sustainably were also prevalent, and study 2 and 3 will shed more light on this. The focus groups, however, revealed that participants felt an increasing pressure in their surroundings for improving their footprint. Thus, study 1 provided insight into drivers and barriers for changes in consumer practices.

We assessed the results in light of the company's parallel innovation process. In order to further investigate the barriers and drivers identified in study 1, we conducted a second study, in which the home service with refill solution was added to the list of scenarios, because the company now considered it as a more promising solution. Study 2 was designed to investigate these factors on a larger, more representative sample.

5. Study 2

5.1. Aim

The aim of the second study was to investigate drivers and barriers of the adoption of refill-based solutions with lower plastic footprint, when factors related to convenience, functionality and social influence were considered.

5.2. Conceptual framework

We built our investigation on the theory of planned behaviour

² We note that other aspects of the data from the focus groups reported in study 1 is also reported on in a different paper by the authors (citation omitted to preserve the integrity of the blind review process).

(TPB) (Ajzen, 1991), which has been used in studies on green consumption (e.g. Bamberg and Möser, 2007; Klöckner, 2013; Ertz et al., 2017). Although the TPB has been criticised for having unreasonable assumptions and for poorly predicting behaviours (Sniehotta et al., 2014), it is shown to be among the attitude-behaviour frameworks that best capture the intention-behaviour relationship (Webb and Sheeran, 2006), with relatively strong reliability and validity (e.g. Ertz et al., 2017). We developed a survey adapted to the context, derived from existing TPB literature (cf. Table 1).

As shown in Fig. 3, the TPB suggests that purchase behaviour is a function of a behavioural intention to purchase, which in turn is shaped by three main variables: attitudes, subjective norm and behavioural control. The former and the latter relate to the functionality and convenience factors revealed in study 1, whereas the normative influence reflects the social pressure dimension revealed in study 1.

Previous literature has demonstrated an attitude-behaviour gap, i.e. a relatively weak relationship between consumers' positive attitudes toward green products and services, and their actual buying behaviour (Vermeir and Verbeke, 2006; White et al., 2019). As pointed out by Podsakoff et al. (2003), measuring intentions to predict behaviour is an imperfect approach due to problems including social desirability and respondent overconfidence. For pro-environmental behaviour, Gatersleben et al. (2002) demonstrated a weak relationship between households' intent and actual behaviours. However, existing research has revealed factors that can contribute to close this gap (Joshi and Rahman, 2015; Guagnano et al., 1995). Finally, several studies have shed light on factors such as normative influences, message framing, and information feedbacks that influence green purchasing behaviour (e.g., Allcott, 2011; Døskeland and Pedersen, 2015).

We investigated attitudes and behavioural intentions related to each of the solutions. Three characteristics that relate to attitudes are relative advantages, complexity and compatibility (Taylor and Todd, 1995). We conceptualise the former as perceived advantages from the respondents' point of view, while we similarly conceptualise complexity and compatibility as perceived risks. Also, we include normative influence on behaviour in our model, informed by the findings from study 1.

5.3. Method

We conducted a nationally representative survey in Norstat to

gather data on consumers' beliefs, attitudes and behavioural intentions related to the prospective scenarios. Participants were presented with the five solutions in Fig. 1. We collected data from 409 respondents, who were largely representative of the Norwegian adult population. The survey measured consumers' beliefs, attitudes and intentions to purchase each of the new solutions. We used Likert scales ranging from 0 to 10. Table 1 gives an overview of items in the survey.

5.4. Findings

The sample consisted of 48.4% female participants, with an average age of 46 years and mean income slightly above \$50,000. Regarding perceived advantages, the *refill in store* solution was perceived to be least expensive and the *smart lock service* most expensive (Table 2, Panel A). The participants found the *big-bag* solution to be more advantageous overall (Table 2, Panel B). The *big-bag refill at home* solution was perceived as most environmentally friendly, whereas the *smart lock service* was perceived as the least environmentally friendly solution (Table 2, Panel C).

Regarding perceived risks, participants perceived the *home cleaning service* as most convenient, whereas the *refill in store* solution was seen as least convenient. However, when ease of functionality and product safety was taken into account, the *big-bag* was perceived as the least risky. Similarly, the *big-bag* solution was perceived to pose least privacy risk, and in line with the focus group findings, the *smart lock service* was considered to pose most privacy risk. Table 3 summarises these results.

Studies 1 and 2 both indicate that adoption of the solutions requires adapting consumption practices. Therefore, we investigated how normative influences might affect consumers' stated willingness to change their buying behaviour. A regression analysis on the influence of social norms on the willingness to change buying behaviour (see Table 4) revealed a significantly positive relationship between respondents' perceived social norms (SN) for sustainability and their willingness to adopt greener consumption habits (w) ($p < 0.05$). Finally, the regression analysis revealed that consumers who feel more guilty about their plastic footprint have greater willingness to change consumption habits ($p < 0.05$). This should perhaps be expected, as the objective of this innovation is to reduce plastic footprints. These findings, however, shed light on the potential power of peer influence on the adoption of green solutions. The findings from study 1 and study 2 revealed similar barriers,

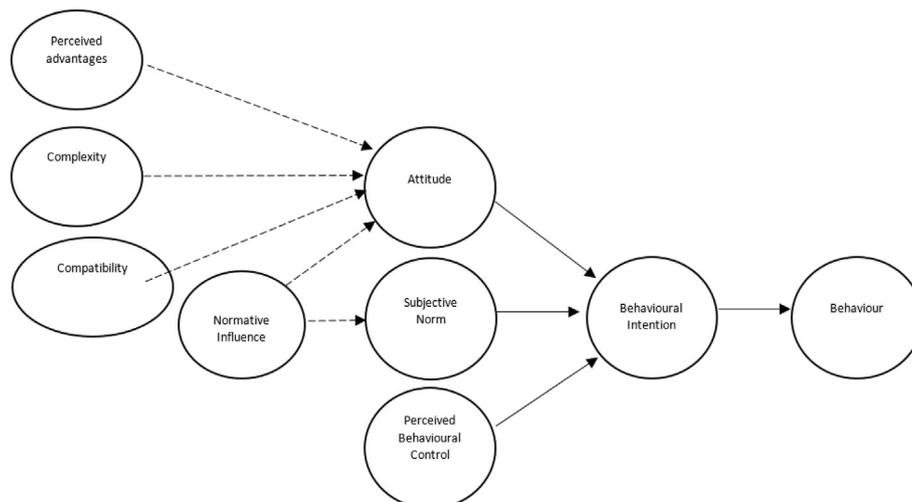


Fig. 3. Expanded model of the theory of planned behaviour (Ajzen, 1991).

Table 2
Panels A–C: Perceived price, environmental friendliness and overall advantageousness of the solutions (Likert scale – 1–10).

Summary Statistics								
Panel A			Panel B			Panel C		
Product Solution	Mean Rank	SD	Product Solution	Mean Score	SD	Product Solution	Mean Rank	SD
Big-bag refill at home	3.96	1.90	Big-bag refill at home	8.20	2.90	Big-bag refill at home	1.93	1.18
Refill in store	4.08	1.73	Refill in store	6.96	3.34	Refill in store	1.97	1.20
Home delivery through smart lock	3.04	1.82	Home delivery through smart lock	4.23	2.95	Home delivery through smart lock	4.60	1.18
Home delivery with groceries	3.09	1.18	Home delivery with groceries	5.48	3.17	Home delivery with groceries	3.85	1.10
Home cleaning service	3.11	1.71	Home cleaning service	5.27	3.11	Home cleaning service	4.05	1.25
* Rank 1 = most expensive solution			*Higher score indicates higher perceived advantages			* Rank 1 = most environmentally friendly		

which may be overcome by means of behavioural interventions. In parallel, Orkla ran value proposition workshops on the scenarios. Informed by the findings from study 2, the company kept faith in the home cleaning service with refill solution, believing that consumers' expectations for convenient solutions would grow. Thus, the company aimed to investigate further the conditions under which a service-based model could succeed. We therefore conducted study 3 on a behavioural intervention aimed at overcoming the barriers associated with adopting the *home cleaning service with refill* solution.

6. Study 3

6.1. Aim

The aim of the third study was to investigate whether a behavioural intervention aimed at reducing the barriers associated with the *home cleaning service with refill* model could reduce consumers' concerns and perceptions of risk associated with such solutions.

6.2. Conceptual framework

Study 2 revealed an interesting contrast between the solutions. On the one hand, some of the solutions are traditional product-based solutions, such as the big bag, which seem to be preferred on the basis of functionality, product safety and lower privacy risk. That is, such solutions more closely resemble the current business model. The other category comprises service-based solutions through which cleaning products are turned into "products-as-services", e.g. home service with refill (see e.g. Bocken, de Pauw, Bakker and van der Grinten, 2016; Tukker, 2004). While seen as more convenient, these solutions require larger behavioural changes. Study 2 revealed opposite types of barriers associated with each solution.

BES is useful in habit-based consumption, for which behavioural interventions can be effective (Verplanken and Wood, 2006; White et al., 2019). We therefore conducted a randomised survey experiment in study 3. The experiment was based on a message framing

logic (e.g. Maheswaran and Meyers-Levy, 1990) in which we made features of the prospective solution salient. Specifically, we intended to investigate whether emphasising the relative environmental friendliness and the safety of the solution could overcome consumers' concerns.

6.3. Method

We designed a randomised online survey experiment on Norstat. We collected responses from 259 participants, who did not already use home cleaning services. They were randomised into four experimental groups (see Fig. 4).

Group 1 acted as a control group and was presented the standard version of the home cleaning service with refill solution. Group 2 received a version with message framing that highlighted its environmental benefits. Group 3 received a version with message framing that highlighted its safety aspects, while group 4 received a combination of the two treatments; both environmental appeal and safety assurance (see Fig. 5).

In order to keep perceptions of price out of the evaluation, respondents were told to envision that they had been given a budget to spend on home cleaning and refilling soap that would allow for selecting this option, if they so desired. Table 5 summarises the variables in the survey. All responses were recorded on a Likert scale from 1 to 7.

6.4. Findings

Of the 259 participants, 51% were women. All participants were aged 25 or older, with an average annual household income of \$80–90k. The data was well-balanced on socio-demographic measures. Table 6 provides an overview on respondents' average attitudinal measures (beliefs and evaluations of beliefs) for the home cleaning service with refill solution, compared to the three experimentally treated versions.

While there were no significant effects for versions 2 and 3, we found a significantly positive effect of the "environmentally friendly

Table 3
Convenience, functionality and product safety scores for the different solutions.

Summary Statistics										
Solution Perceived Risks	Big-bag refill at home		Refill in store		Home delivery through smart lock		Home delivery with groceries		Home cleaning service	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Convenience	5.47	2.36	7.10	2.14	5.62	2.73	5.46	2.57	5.17	2.88
Functionality	4.00	3.24	5.64	3.48	7.40	3.06	6.65	3.24	6.53	3.23
Product Safety	5.00	3.38	6.79	3.29	8.17	2.81	8.06	2.82	8.03	3.01
* lower score indicates lower risk										
Privacy	9.43	2.39	8.85	2.75	4.61	2.96	6.44	3.04	5.60	3.05

* lower score indicates higher risk.

§ Green and red colours indicate the best and worst performing scenarios, respectively, for each risk.

Table 4
Regression analysis on stated willingness to change consumption practices.

Summary Statistics		
	Willingness to change	Confidence Interval
Social norms	0.427***	[0.344,0.510]
Environmental conscientiousness	0.300***	[0.235,0.366]
Age	-0.00931	[-0.0191,0.000524]
Education	0.00487	[-0.00545,0.0152]
_cons	3.363***	[2.623,4.102]
N	409	

95% confidence intervals in brackets.
p* < 0.05, *p* < 0.01, ****p* < 0.001.

and safe” solution (version 4) compared to the baseline. The behavioural intention of participants to adopt the home service with refill solution increased by 0.64 units when they received this treatment (*p* < 0.05). Thus, the “environmental and safe” message framing led to greater consumer inclination to adopt (see Fig. 6).

Furthermore, we found that consumers who perceived the solution as inexpensive, high quality and more convenient were more

inclined to use the solution. Older participants were less willing to use the service, which suggests that younger adults place higher value on convenience (cf. Swoboda and Morschett, 2001). All the above-mentioned variables, except age, were also statistically significant for the second dimension of behavioural intention, namely the willingness of the participants to recommend the solution. We found no significant difference of the impact of the treatments for people who expressed higher environmental concern. Therefore, we ruled out any moderation effects for environmental concern Table 7.

7. General discussion

In this paper, we have investigated a BES process for greener value propositions in FMCG. Through qualitative and quantitative empirical inquiries that fed into the BES process, we revealed barriers and drivers for the adoption of these solutions, and interventions to overcome barriers. Such insights can in turn inform BES processes in FMCG and beyond. Our empirical investigation thus relates to two levels: at a micro-level, to consumers’ responsiveness to green

Table 5
Survey instrument.

Variables for Survey Experiment in Study 3			
Construct	Variable	Description	Cronbach's alpha
Behavioural Intention	BI 1	I would use home cleaning service with refill	0.9328
	BI 2	I would recommend home cleaning service with refill to friends and family	
	BI 3	I think that home cleaning service with refill is a good idea.	
Environmental Friendliness	Belief	I think that home cleaning service with refill is an environmentally friendly solution.	0.6837
	Evaluation of Belief	When evaluating home cleaning service with refill, it is important to me that the service is environmentally friendly	
Safety and Security	Belief	I think that home cleaning service with refill is a safe and secure solution.	0.6329
	Evaluation of Belief	When evaluating home cleaning service with refill, it is important to me that the service is safe and secure	
Personal Norm	Environmental Consciousness (PN 1)	I take the environment into account when shopping for products and services in everyday life (e.g. food, transportation, etc.)	0.6158
	Environmental Consciousness (PN 2)	I believe that man-made climate change is a major problem in society today	
Social Norm Controls	Normative Influence (SN)	I think it is important what my friends and family think of home cleaning service with refill.	0.8114
	Price	I think that home cleaning service with refill appears as an inexpensive service.	
	Quality	I think that home cleaning service with refill appears as a high-quality service.	
Socio-Demographics	Convenience	I think that home cleaning service with refill appears as a simple and convenient service	
	Age		
	Gender		
	Income		
	Education		

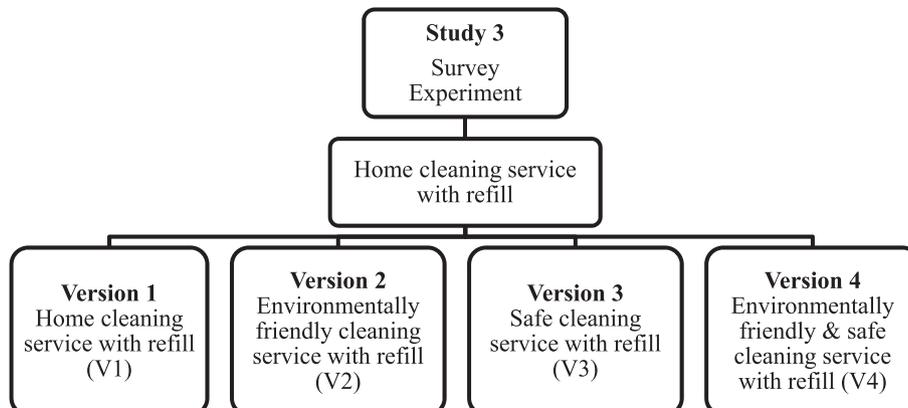


Fig. 4. Survey-experimental design.

Intervention image	Intervention message	Group
 <p>Home-Service</p>	<p>Heading: Now we offer home cleaning services with refill</p> <p>Body text: Our cleaners clean your house and refill the containers of your cleaning products. Always a clean house with full cleaning product containers.</p>	Control group 1
 <p>Environmentally Friendly Home-Service</p>	<p>Heading: Now we offer environmentally friendly home cleaning services with refill</p> <p>Body text: Our cleaners clean your house and refill the containers of your cleaning products. They use exactly the right amount of soap, and refilling your cleaning products saves the environment from plastic waste.</p>	Treatment group 2
 <p>Secured Home-Service</p>	<p>Heading: Now we offer safe home cleaning services with refill</p> <p>Body text: Our professional cleaners clean your house and refill the containers of your cleaning products. The cleaners have been carefully selected and trained by us, and you can trust them.</p>	Treatment group 3
 <p>Environmentally Friendly & Secured Home-Service</p>	<p>Heading: Now we offer environmentally friendly and safe home cleaning services with refill</p> <p>Body text: Our professional cleaners clean your house and refill the containers of your cleaning products. The cleaners have been carefully selected and trained by us. They use exactly the right amount of soap, and refilling your cleaning products saves the environment from plastic waste.</p>	Treatment group 4

Fig. 5. Treatments and treatment groups in the survey experiment.

innovations, and at a broader level, the process of BES in companies' efforts to enable such consumer behaviour.

In study 1, we shed light on the challenge of changing consumer habits. The participants viewed the refill solutions effortful quite like reusable shopping bags, which are also perceived as inconvenient by the shoppers who are unaccustomed with them (Wilson et al., 2011). Interestingly, participants did not perceive the service-based models as improvements regarding the plastic problem. This suggested that the environmental dimensions of such models needed to be communicated well to consumers (Bocken et al., 2014). The participants were also concerned with privacy and safety, especially older participants. As domestic cleaning services are becoming more widespread, this can be suggestive of the younger population prioritizing convenience (Lutz, 2002).

Study 2 expanded on these findings and revealed that social norms and peer influence were drivers of green consumption. This aligns with prior studies on social influence on green consumer behaviour, e.g. for solar energy equipment and organic food

(Welsch and Kühling, 2009), reduction of meat consumption (Sparkman and Walton, 2017) and other domains of consumption (White et al., 2019; Peattie, 2010). Study 2 also suggested that consumers' willingness to change habits could be more likely in younger generation, although previous research is unclear on direction and strength of such age-effects (Wiernik et al., 2013).

The company believed that consumer convenience would be important for consumers, and therefore decided to further explore the home service with refill solution. Prior research also shows that convenience is important for consumer adoption of green innovations (Ottman et al., 2006; Seyfang, 2005), and our subsequent empirical investigation took this as point of departure. Consequently, study 3 investigated the possibility to overcome barriers for the adoption of the home service with refill. Explicitly informing consumers on the environmental friendliness and safety of the solution made it more attractive and consumers were more likely to adopt it. This aligns with previous research showing that message-framing techniques promote consumer adoption of pro-

Table 6
Mean scores for control and intervention groups.

Summary Statistics		Control	Environmentally friendly	Safe	Safe and environmentally friendly
Environmental Friendliness	Belief	4.12 (1.74)	4.38 (1.70)	3.71 (1.74)	4.86 (1.80)
	Evaluation of Belief	4.50 (1.89)	4.53 (1.65)	4.12 (1.87)	5.48 (1.57)
	Attitude (Belief x Evaluation)	20.49 (14.30)	21.5 (11.87)	16.35 (11.90)	28 (14.41)
Safety and security	Belief	4.33 (1.69)	4.37 (1.44)	4.03 (1.88)	4.65 (1.86)
	Evaluation of Belief	5.71 (1.31)	5.53 (1.48)	5.59 (1.58)	6.17 (1.32)
	Attitude (Belief x Evaluation)	25.76 (12.80)	25.37 (11.26)	24.23 (14.69)	29.52 (14.28)

Table 7
Regression analysis on behavioural intentions in Study 3.

Summary Statistics				
	(1)		(2)	
	BI1	Confidence Interval	BI1	Confidence Interval
Version 2	0.109	[-0.646,0.865]	0.200	[-0.446,0.847]
Version 3	-0.309	[-1.064,0.447]	0.414	[-0.275,1.103]
Version 4	0.687*	[0.0131,1.361]	0.648*	[0.0590,1.238]
Price			0.241**	[0.0607,0.421]
Quality			0.519***	[0.310,0.728]
Convenience			0.304***	[0.126,0.482]
PN1			-0.0905	[-0.247,0.0664]
PN2			-0.000883	[-0.143,0.141]
Age			-0.0189*	[-0.0341,-0.00382]
female			-0.102	[-0.550,0.347]
Income			-0.0172	[-0.0826,0.0481]
Edu			0.0376	[-0.163,0.239]
SN				
_cons	3.509***	[2.979,4.038]	0.465	[-1.009,1.939]
N	259		207	

95% confidence intervals in brackets.

*p < 0.05, **p < 0.01, ***p < 0.001.

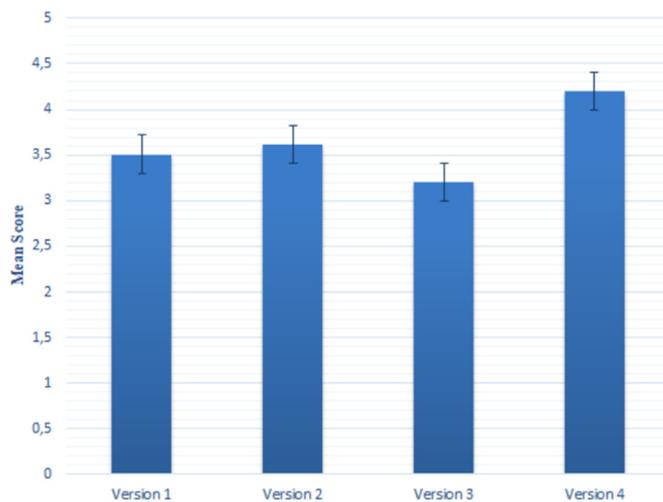


Fig. 6. Consumers' intention to use different versions of the home cleaning service.

environmental behaviours (e.g., Morton et al., 2011; Hanss and Böhm, 2013).

The home cleaning service solution is akin to a Sustainable Product-Service System (S.PSS), and it has been argued in previous studies that consumers often undervalue the benefits of a S.PSS offering and overvalue its costs and risks (Vezzoli et al., 2015). Our findings in study 2 indeed showed that consumers viewed this solution less favourably. However, by means of message framing,

we induced a lower risk perception among consumers. Thus, our findings contribute to the understanding of S.PSS adoption. According to Vezzoli et al. (2015), adoption of S.PSS solutions requires transition-oriented designs to encourage consumer acceptance. BES is one approach through which companies can design and encourage the adoption of such solutions.

On a broader level, our paper engages in a meta-narrative of a BES process in FMCG. Our studies contribute to the understanding of the different stages and actions companies can undertake in order to arrive at actionable insights. Previous research (e.g. Bocken et al., 2019) argues that BES is an iterative process of trial and error requiring companies to engage stakeholders, conduct focus groups or A/B testing, develop prototypes before arriving at the final product that offer better value proposition for the customers. This paper has investigated such processes in a large incumbent company and how consumer insights can be generated by means of BES.

With the dual goals of plastic avoidance and attractive solutions in mind, the company engaged in a comprehensive BES process. Insights from consumers made it possible to assess and understand the strengths and weaknesses of the different prospective business models, as the company tried to align sustainability goals and traditional business goals (cf. Bocken et al., 2018). In particular, the A/B-test approach in study 3 allowed for digging deeper into how small changes in the presentation of the value proposition could lead to different beliefs and behavioural intentions on the part of consumers. This informed the ongoing process of value proposition design in the company – a design choice of substantial importance in the design of more sustainable business models (Schaltegger et al., 2012).

So, how can BES be done in practice? It is important to highlight that BES is a comprehensive process of change. It is an important innovation capability for organizations in uncertain environments (Chesbrough, 2010; Weissbrod and Bocken, 2017), it can benefit from a combination of data sources and data collection approaches, and a combination of evidence-based decisions and intuition-based assessments (cf. Bocken et al., 2019). In the case of Orkla, this implied moving from a highly successful product-based business model towards prospective service-based models with very different value creation, delivery and capture than its current offerings. For large firms with strong positions in the marketplace, such innovation processes can be challenging. However, on the flipside, large companies have the resources to carry out comprehensive BES processes (cf. Weissbrod and Bocken, 2017). BES, which involves reiterative bouts of analysis, experimentation and design (cf. Fig. 1) can be central to innovation and can lead a company from its current business model to a new one. Using structured approaches for reiteratively designing, hypothesising and testing can thus generate knowledge-based and actionable insights that can inform and drive BES in practice.

8. Conclusion and implications

BES can enable companies' transition from an existing business model to a new and more sustainable business model. This requires a reiterative approach to design, experimentation and analysis that can generate actionable insights on barriers for the adoption of such solutions, and interventions to overcome them. In this study, we have shed light on how parallel and intertwined innovation and experimentation processes can inform such a transition. Our three studies revealed drivers and barriers for more sustainable business models in FMCG and unveiled possible approaches for overcoming barriers to adoption. In doing so, the studies also shed light on the reiterative nature of BES in practice.

Our paper has implications for our understanding of consumers' green consumption behaviour in general and for S.PSS models in particular. We show that while consumers may not be readily receptive to green value propositions, barriers can be overcome through behavioural interventions to promote sustainable consumption, including message framing as demonstrated in this paper. The cross-sector collaboration between companies and researchers reflected in the paper shows its potential for applying knowledge-based approaches in BES. Furthermore, the paper contributes to the growing field of sustainable business model innovation. As argued by Baldassarre et al. (2020), there is a design-implementation gap that hinders diffusion of such business models. Our paper empirically shows how companies can engage in the process of business experimentation to address this gap, in a manner that caters to consumer preferences.

From a managerial point of view, cross-sector collaboration between companies and researchers can allow for the application of scientific methods in the pursuit of actionable, evidence-based insights for innovation purposes. The uncertainty involved in a company's pursuit of sustainable innovation can be reduced by applying such approaches to BES. As noted by Kennedy and Bocken (2020), there is a lack of research on the type of experimentation required for companies to transition to sustainable business models and the types of questions companies should explore in such experimentation. Our paper offers a case of value proposition experimentation and provides insights on the types of knowledge companies could aim to extract. Future research should further investigate empirical applications to business model innovation. Moreover, through multiple studies, we shed light on how collecting data in a combination of more and less controlled environments both in the lab and the field can allow for richer data for

making decisions. We ran our experiments on product solutions that the company found commercially viable to pursue, which shows that BES can be aligned with the commercial objectives of the company. Finally, the paper offers insights to managers on how behavioural interventions can be used effectively for consumer adoption of innovative product solutions.

8.1. Limitations and future research

BES is an emerging topic and future research can build on this work for further investigation. A limitation of our paper is that we rely on self-reporting from participants. Actual behaviour may differ from stated intentions, as noted in our discussion of the intention-behaviour gap above. For example, it is possible that the respondents may underestimate barriers to adoption, as they might struggle to correctly envision the needed behaviour. Social desirability also comes into play, as people tend to perceive themselves as more pro-environmental than they really are (Podsakoff et al., 2003). However, we aimed to mitigate this challenge by placing questions that explicitly relate to environmental issues at the end of the survey. Future research can also overcome such limitations by conducting natural field experiments on actual behaviour, which allow for controlled testing on real decisions.

Furthermore, we investigated products for which consumers have habitual buying behaviour. It is possible that for other products and services, where consumers are more engaged, simple behavioural interventions might not be sufficient. Future research could explore how BES could feed into the design of sustainable business models for such product categories. It should be noted in relation to this that our company-researcher collaboration to some degree constrained our ability to freely design the study, since the research design in part hinged on parallel choices in Orkla's innovation process. However, we independently designed and conducted our study, and this constraint is also a strength, in the sense that it allowed us to closely collaborate with the firm on the BES process.

A further limitation is that the focus group study might suffer from a groupthink bias. For instance, it could be that not all shared viewpoints were held by all participants. However, this is an inherent characteristic of focus groups, which are intended to generate data from the conversation and interplay between people. The studies were conducted in Norway, which has a population with relatively high income, education and environmental awareness (Orderud and Kelman, 2011). Thus, one can question how far the results generalize. For instance, it has been suggested that the S.PSS systems such as home service are more positively received in communal societies such as Scandinavia, the Netherlands and Switzerland (Wong, 2004). Future studies should investigate these issues in different contexts and cultures. Finally, this paper has focused on experimentation for sustainable business models, but it does not investigate the sustainability impact of the prospective value propositions. Future research can take a more holistic approach and include such investigation.

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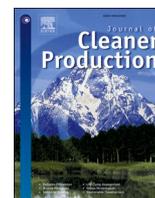
collaborating with us on this research. There are no conflicts of interest to report.

References

- Abdelkafi, N., Täuscher, K., 2016. Business models for sustainability from a system dynamics perspective. *Organ. Environ.* 29 (1), 74–96.
- Ajzen, I., 1991. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* 50 (2), 179–211.
- Allcott, H., 2011. Social norms and energy conservation. *J. Publ. Econ.* 1082–1095.
- Andries, P., Debackere, K., Looy, B., 2013. Simultaneous experimentation as a learning strategy: business model development under uncertainty. *Strat. Entrepren. J.* 7 (4), 288–310.
- Ashford, N.M., Hall, R., 2011. *Technology, Globalization and Sustainable Development: Transforming the Industrial State*. Yale University Press, New Haven, CT.
- Baldassarre, B., Konietzko, J., Brown, P., Calabretta, G., Bocken, N., Karpen, I.O., Hultink, E.J., 2020. Addressing the design-implementation gap of sustainable business models by prototyping: a tool for planning and executing small-scale pilots. *J. Clean. Prod.* 255, 120295.
- Bamberg, S., Möser, G., 2007. Twenty years after Hines, Hungerford, and Tomera: a new meta-analysis of psycho-social determinants of pro-environmental behaviour. *J. Environ. Psychol.* 27 (1), 14–25.
- Bocken, N.M., Allwood, J.M., 2012. Strategies to reduce the carbon footprint of consumer goods by influencing stakeholders. *J. Clean. Prod.* (35), 118–129.
- Bocken, N.M., de Pauw, I., Bakker, C., van der Grinten, B., 2016. Product design and business model strategies for a circular economy. *J. Ind. Prod. Eng.* 33 (5), 308–320.
- Bocken, N., Antikainen, M., 2018. Circular Business Model Experimentation: Concept and Approaches. *Sustainable Design And Manufacturing*. Springer, Cham, pp. 239–250.
- Bocken, N., Boons, F., Baldassarre, B., 2019. Sustainable business model experimentation by understanding ecologies of business models. *J. Clean. Prod.* 208, 1498–1512.
- Bocken, N., Schuit, C., Kraaijenhagen, C., 2018. Experimenting with a circular business model: lessons from eight cases. *Environ. Inn. Soc. Trans.* 28, 79–95.
- Bocken, N., Short, S., Rana, P., Evans, S., 2014. A literature and practice review to develop sustainable business model archetypes. *J. Clean. Prod.* 65, 42–56.
- Boons, F., Lüdeke-Freund, F., 2013. Business models for sustainable innovation: state-of-the-art and steps towards a research agenda. *J. Clean. Prod.* 45, 9–19.
- Chesbrough, H., 2007. Business model innovation: it's not just about technology anymore. *Strat. Leader.* 35 (6), 12–17.
- Chesbrough, H., 2010. Business model innovation: opportunities and barriers. *Long. Range Plan.* 43 (2), 354–363.
- Chesbrough, H., Rosenbloom, R.S., 2002. The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. *Ind. Corp. Change* 11 (3), 529–555.
- Claudy, M.C., Garcia, R., O'Driscoll, A., 2015. Consumer resistance to innovation—a behavioural reasoning perspective. *J. Acad. Market. Sci.* 43 (4), 528–544.
- Døskeland, T., Pedersen, L.J., 2015. Investing with brain or heart? A field experiment on responsible investment. *Manag. Sci.* 62 (6), 1632–1644.
- De Medeiros, J.F., Ribeiro, J.L.D., Cortimiglia, M.N., 2014. Success factors for environmentally sustainable product innovation: a systematic literature review. *J. Clean. Prod.* 65, 76–86.
- Ertz, M., Huang, R., Jo, M.S., Karakas, F., Sarigöllü, E., 2017. From single-use to multi-use: study of consumers' behavior toward consumption of reusable containers. *J. Environ. Manag.* 193, 334–344.
- Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E.A., Barlow, C.Y., 2017. Business model innovation for sustainability: towards a unified perspective for creation of sustainable business models. *Bus. Strat. Environ.* 26 (5), 597–608.
- Featherman, M.S., Pavlou, P.A., 2003. Predicting e-services adoption: a perceived risk facets perspective. *Int. J. Hum. Comput. Stud.* 59 (4), 451–474.
- Gatersleben, B., Steg, L., Vlek, C., 2002. Measurement and determinants of environmentally significant consumer behavior. *Environ. Behav.* 34 (3), 335–362.
- Geissdoerfer, M., Bocken, N.M., Hultink, E.J., 2016. Design thinking to enhance the sustainable business modelling process—A workshop based on a value mapping process. *J. Clean. Prod.* 135, 1218–1232.
- Geissdoerfer, M., Vladimirova, D., Evans, S., 2018. Sustainable business model innovation: a review. *J. Clean. Prod.* 198, 401–416.
- Guagnano, G.A., Stern, P.C., Dietz, T., 1995. Influences on attitude-behavior relationships: a natural experiment with curbside recycling. *Environ. Behav.* 27 (5), 699–718.
- Hanss, D., Böhm, G., 2013. Promoting purchases of sustainable groceries: an intervention study. *J. Environ. Psychol.* 53–67.
- Jansson, J., 2011. Consumer eco-innovation adoption: assessing attitudinal factors and perceived product characteristics. *Bus. Strat. Environ.* 20 (3), 192–210.
- Joshi, Y., Rahman, Z., 2015. Factors affecting green purchase behaviour and future research directions. *Int. Strat. Manag. Rev.* 3 (1–2), 128–143.
- Kennedy, S., Bocken, N., 2020. *Innovating Business Models for Sustainability: an Essential Practice for Responsible Managers*. The Research Handbook of Responsible Management. Edward Elgar, Cheltenham.
- Klößner, C.A., 2013. A comprehensive model of the psychology of environmental behaviour—a meta-analysis. *Global Environ. Change* 23 (5), 1028–1038.
- Lehner, M., Mont, O., Heiskanen, E., 2016. Nudging – a promising tool for sustainable consumption behaviour? *J. Clean. Prod.* 134, 166–177.
- Lutz, H., 2002. At your service madam! the globalization of domestic service. *Fem. Rev.* 70 (1), 89–104.
- McGrath, R.G., 2010. Business models: a discovery driven approach. *Long. Range Plan.* 43 (2–3), 247–261.
- Maheswaran, D., Meyers-Levy, J., 1990. The influence of message framing and issue involvement. *J. Market. Res.* 27 (3), 361–367.
- Meuter, M.L., Bitner, M.J., Ostrom, A.L., Brown, S.W., 2005. Choosing among alternative service delivery modes: an investigation of customer trial of self-service technologies. *J. Market.* 69 (2), 61–83.
- Moore, G.C., Benbasat, I., 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. *Inf. Syst. Res.* 2 (3), 192–222.
- Morton, T.A., Rabinovich, A., Marshall, D., Bretschneider, P., 2011. The future that may (or may not) come: how framing changes responses to uncertainty in climate change communications. *Global Environ. Change* 21 (1), 103–109.
- Nambisan, S., 2009. Platforms for collaboration. *Stanford Soc. Innovat. Rev.* 7 (3), 44–49.
- Orderud, G.I., Kelman, I., 2011. Norwegian mayoral awareness of and attitudes towards climate change. *Int. J. Environ. Stud.* 68 (5), 667–686.
- Ottman, J.A., Stafford, E.R., Hartman, C.L., 2006. Avoiding green marketing myopia: ways to improve consumer appeal for environmentally preferable products. *Environment* 48 (5), 22–36.
- Paul, J., Modi, A., Patel, J., 2016. Predicting green product consumption using theory of planned behavior and reasoned action. *J. Retailing Consum. Serv.* 29, 123–134.
- Peattie, K., 2010. Green consumption: behavior and norms. *Annu. Rev. Environ. Resour.* (35), 195–228.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88 (5), 879.
- Rishi, B., 2013. Determinants of brand trust for FMCG products with special reference to shampoos category. *Asia Pacific J. Manag. Res. Inn.* 9 (2), 221–227.
- Roome, N., Louche, C., 2016. Journeying toward business models for sustainability: a conceptual model found inside the black box of organisational transformation. *Organ. Environ.* 29 (1), 11–35.
- Sachdeva, S., Jordan, J., Mazar, N., 2015. Green consumerism: moral motivations to a sustainable future. *Curr. Op. Psychol.* 6, 60–65.
- Schaltegger, S., Lüdeke-Freund, F., Hansen, E.G., 2012. Business cases for sustainability: the role of business model innovation for corporate sustainability. *Int. J. Innovat. Sustain. Dev.* 6 (2), 95–119.
- Seyfang, G., 2005. Shopping for sustainability: can sustainable consumption promote ecological citizenship? *Environ. Polit.* 14 (2), 290–306.
- Sniehotta, F.F., Presseaux, J., Araújo-Soares, V., 2014. Time to retire the theory of planned behaviour. *Health Psychol. Rev.* 8 (1), 1–7.
- Sparkman, G., Walton, G.M., 2017. Dynamic norms promote sustainable behavior, even if it is counternormative. *Psychol. Sci.* 28 (11), 1663–1674.
- Stewart, D.W., Shamdasani, P.N., 2014. *Focus Groups: Theory and Practice*. Sage Publications.
- Schiffstein, H.N., 2001. Effects of product beliefs on product perception and liking. In: *Food, People and Society*. Springer, Berlin, Heidelberg, pp. 73–96.
- Swoboda, B., Morschett, D., 2001. Convenience-oriented shopping: a model from the perspective of consumer research. In: *Food, People and Society*. Springer, Berlin, Heidelberg, pp. 177–196.
- Taylor, S., Todd, P., 1995. Decomposition and crossover effects in the theory of planned behavior: a study of consumer adoption intentions. *Int. J. Res. Market.* 12 (2), 137–155.
- Teece, D.J., 2010. Business models, business strategy and innovation. *Long. Range Plan.* 43 (2–3), 172–194.
- Thomke, S., Manzi, J., 2014. The discipline of business experimentation. *Harv. Bus. Rev.* 92 (12), 70–79.
- Tukker, A., 2004. Eight types of product-service system: eight ways to sustainability? Experiences from SusProNet. *Bus. Strat. Environ.* 13 (4), 246–260.
- Vermeir, I., Verbeke, W., 2006. Sustainable food consumption: exploring the consumer “attitude behavioral intention” gap. *J. Agric. Environ. Ethics* 19 (2), 169–194.
- Verplanken, B., Wood, W., 2006. Interventions to break and create consumer habits. *J. Publ. Pol. Market.* 25 (1), 90–103.
- Vezioli, C., Ceschin, F., Diehl, J.C., Kohtala, C., 2015. New design challenges to widely implement ‘sustainable product-service systems’. *J. Clean. Prod.* 97, 1–12.
- Wagner, E.R., Hansen, E.N., 2005. Innovation in large versus small companies: insights from the US wood products industry. *Manag. Decis.* 43 (6), 837–850.
- Webb, T.L., Sheeran, P., 2006. Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychol. Bull.* 132 (2), 249.
- Weissbrod, I., Bocken, N.M., 2017. Developing sustainable business experimentation capability – a case study. *J. Clean. Prod.* 2663–2676.
- Welsch, H., Kühling, J., 2009. Determinants of pro-environmental consumption: the role of reference groups and routine behavior. *Ecol. Econ.* 69 (1), 166–176.
- White, K., Habib, R., Hardisty, D.J., 2019. How to shift consumer behaviors to be more sustainable: a literature review and guiding framework. *J. Market.* 83 (3), 22–49.
- White, K.M., Smith, J.R., Terry, D.J., Greenslade, J.H., McKimmie, B.M., 2009. Social influence in the theory of planned behaviour: the role of descriptive, injunctive,

- and in-group norms. *Br. J. Soc. Psychol.* 48 (1), 135–158.
- Wiernik, B.M., Ones, D.S., Dilchert, S., 2013. Age and environmental sustainability: a meta analysis. *J. Manag. Psychol.* 28 (7/8), 826–856.
- Wilson, L.A.M., Strodl, E., Turrell, G., 2011. Identifying the Beliefs Which Predict Environmentally Friendly Behaviour in the Brisbane Area: a Foundation for Informed Interventions.
- Wong, M.T.N., 2004. Implementation of Innovative Product Service Systems in the Consumer Goods Industry. Doctoral dissertation, University of Cambridge.

CHAPTER III



Leveraging technology to communicate sustainability-related product information: Evidence from the field

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ABSTRACT

The information gap between businesses and consumers concerning the sustainability impacts of products and services is considered a key obstacle impeding sustainable consumption. To that end, mobile technologies, such as QR codes, have been identified as a useful tool that can bridge this information gap by providing consumers with sustainability-related product information at the point of purchase. However, the literature offers scarce insights into the factors that influence consumers' intention to use QR codes for sustainability-related product information in daily consumption decisions. This paper investigates this relationship in two studies of consumer acceptance of QR codes. Study 1 utilises the Technology Acceptance Model to study the factors that may affect consumers' intention to scan QR codes with sustainability information. The results show that the perceived ease of use and the perceived usefulness of the QR codes are significant predictors of consumers' attitudes towards and intentions to scan QR codes. Further analysis shows that QR codes visuals and written appeals may also affect scan intention. The extant literature lacks evidence from investigations of real-life behaviour. Study 2 contributes to this gap in the literature by investigating the usage of QR codes in a field experiment. The results show an overall scan rate of 4.22% for the QR codes, with consumers scoring high on perceived usefulness of QR codes, perceived sustainability quality of the product and preference for using QR codes in the future. Importantly, QR codes with a suggestive appeal were scanned at higher rates than that of QR codes without such appeal. The paper thus responds to calls for research on how companies can leverage marketing innovations using technology to communicate sustainability-related product information to consumers and stimulate sustainable consumption.

1. Introduction

Sustainable consumption is a vital component of sustainable development (Bocken and Allwood, 2012). Consumers are increasingly aware of their environmental and social footprints as well as the role of their consumption in environmental degradation (Jaca et al., 2018). More and more consumers intend to change their consumption practices and choose sustainable products and services (Young et al., 2010). Businesses are also expected to devise strategies that facilitate sustainable consumption (Bocken and Allwood, 2012).

In the transition to more sustainable consumption patterns, the communication of product-related sustainability information from companies to their customers can also stimulate sustainable consumption (Vega-Zamora et al., 2019). Information is an important factor that influences consumers' willingness to adopt sustainable behaviours (White et al., 2019). Inefficient communication of sustainability-related product information to consumers can be a major barrier to sustainable

consumption (Shao et al., 2016). Various marketing innovations that can lead to better communication of sustainability information to consumers are therefore needed (Shao et al., 2016). The communication gap related to the sustainability characteristics of products and services often occurs at the point of purchase, where such information may be lacking (Shao and Ünal, 2019). In this context, existing research suggests leveraging technology to provide consumers with sustainability-related product information (e.g. Kim and Woo, 2016). However, there are scarce insights into the effectiveness of such technological marketing innovations and the factors that influence their utilisation. This paper aims to contribute to this gap in the literature.

Various technologies can serve as fruitful tools for the communication of products' sustainability characteristics (Atkinson, 2013). For instance, mobile devices empower consumers by giving them greater access to useful sustainability-related product information on demand and in the retail environment (Atkinson, 2013). A mobile technology that is becoming increasingly prevalent and useful for providing instant

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access to sustainability information is QR codes. A *Quick Response (QR) Code* is a two-dimensional barcode that can be read by digital devices, such as smartphones, to access information about the object to which it is attached.

QR codes have seen a resurgence during the covid pandemic as they offer quick, easy and “touch-free” access to important and relevant information (Gostin, 2021; Silverberg, 2021). Despite the proliferation of the technology, academic research on QR codes has been scarce and the extant literature offers little guidance on the factors that affect consumer’s scan intention of QR codes (Okazaki et al., 2019). For instance, how does a visual cue or contextual information affect scan intention? What is the best placement for a QR code? How likely are consumers to use QR codes in everyday settings? The existing knowledge is vague on such questions related to the technology, especially in the context of sustainable consumption (Atkinson, 2013). There is a clear lack of field studies on QR codes that could offer evidence on actual consumer usage of the technology (Okazaki et al., 2019). This paper aims to contribute to this research gap by presenting new knowledge on consumer acceptance of QR codes, the drivers and barriers to scan QR codes for accessing sustainability-related product information, and consumers’ inclination to use QR codes in real-life settings. Thus, the paper makes contributions to the literature at two levels: First, it contributes novel insights made possible by the use of a field-experimental empirical strategy. Second, it contributes to the theoretical understanding of how QR technology can be used to communicate sustainability-related product information to consumers and thus stimulate sustainable consumption.

In collaboration with a large fast-moving consumer goods (FMCG) company in Norway, the paper studies consumers’ intention to use QR codes in daily purchases in two studies. In Study 1, which is an online survey (n = 250) based on the Technology Acceptance Model (TAM), I investigate factors that influence consumers’ intention to scan QR codes. It sheds light on important attributes of an effective QR code. However, there is a lack of research on the actual scanning behaviour of consumers when exposed to the QR codes (Okazaki et al., 2019). Therefore, Study 2 comprises a field experiment (n = 157)¹ that sheds light on the efficacy of QR codes to communicate sustainability-related product information in an actual shopping setting.

The paper aims to contribute insights of both theoretical and managerial relevance. The paper aims to advance the knowledge on the use of QR codes to communicate the sustainability characteristics of products. Companies’ continuing interest in QR codes has surged during the covid pandemic in which contactless interaction has become more desirable (Gostin, 2021). A few studies have tried to understand the factors that prompt consumers to scan QR codes (e.g. Okazaki et al., 2019; Atkinson, 2013). However, existing studies lack evidence in the context of sustainable consumption and do not test actual scanning behaviour. The present paper provides insights into such behaviour from the field. In this way, the findings from the paper inform companies that aim to leverage QR code technology for communicating sustainability-related product information. The paper also responds to calls for research on how marketing innovations can be utilised to promote sustainable consumption (e.g., Dangelico and Vocalelli, 2017; Gerstlberger et al., 2014; Peattie and Peattie, 2009).

The remainder of the paper proceeds as follows. First, I review the knowledge on the information gap between companies and consumers and the role of technology to fill this gap. Next, I outline each of the two

¹ Calculating a precise number of observations is difficult in this field experiment. A total of 3720 QR codes were pasted on the products in the stores. These products stayed on the shelves of four retail stores and thousands of people got exposed to the QR codes as they shopped in the stores. In this regard, one can envision all of these people to be part of the experiment. However, when reporting the number of observations for the field experiment, I use the conservative number n = 157, which refers to the total number of scans of these 3720 QR codes.

studies and their respective findings. Finally, I discuss the findings of the two studies and outline theoretical and practical implications thereof.

2. The information gap: a barrier to sustainable consumption

Let us take as a point of departure the role of structural factors in determining sustainable consumer behaviour (cf. Sachdeva et al., 2015). Sustainable consumption behaviour is a result of a combination of endogenous, exogenous, and structural factors (Sachdeva et al., 2015). Endogenous factors relate to the personal values and beliefs of consumers, exogenous factors are a function of the social norms, cultural acceptability and social reputation that influence consumers, and structural factors refer to the choice-architectural factors that affect the decision environments in which the purchasing behaviour takes place (Sachdeva et al., 2015). For instance, information provision and the framing of such information are important structural factors that stimulate sustainable consumption behaviour. Specifically, they influence which factors the consumer takes into account and the manner in which choices are framed when the consumer is facing a choice between various products or services (cf. Hardisty et al., 2010; Davis, 1995). These three layers of sustainable consumer behaviour are illustrated in Fig. 1.

This framework serves as a backdrop for understanding the drivers and barriers of sustainable consumption. For instance, existing literature shows that many consumers are willing to choose sustainable products or services that can reduce the negative footprints of their consumption. This can be motivated by a combination of endogenous and exogenous factors, such as sustainable consumption giving a sense of meaning or enabling them to communicate their values and lifestyle preferences (Meise et al., 2014; De Pelsmacker et al., 2005). Despite such stated preferences for green products and services, many consumers can find it difficult to translate their values into actual buying behaviour due to structural barriers in the form of lacking sustainability-related product information (Tseng and Hung, 2013). It has been argued that even among green consumers, who are more mindful about sustainability, there is a perception of lacking sustainability-related product information at the point of purchase (Shao, 2016).

A different facet of this information gap relates to the sustainability information provision of current market offerings (for instance through

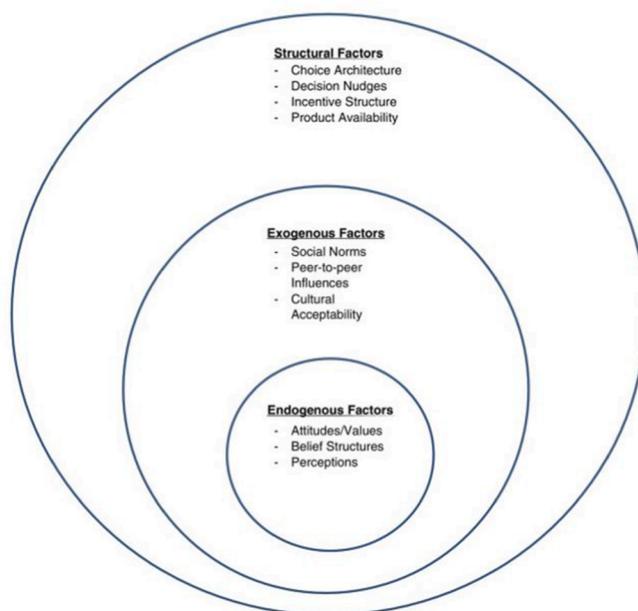


Fig. 1. Multi-level factor model of sustainable consumer behaviour (based on Sachdeva et al., 2015).

eco-labels) and the actual informational needs of consumers (Meise et al., 2014). There is a risk that the sustainability-related information provided to consumers is mismatched with respect to those consumers' information needs and their proficiency to acquire and utilise the information in purchase decisions (Shao and Ünal, 2019). For instance, sustainability information communicated to consumers via different channels, such as eco-labels, may either be irrelevant to the average consumer or provide incomplete information on relevant environmental and social metrics (Rex and Baumann, 2007; Shao, 2016). Consequently, there may be a gap between consumers' expectations of the products with regard to sustainability characteristics and their perceptions of the products along such dimensions, based on the available information (Tseng and Hung, 2013; Shao, 2016). This "expectation-perception" gap is attributed to the inadequate sustainability-related product information given to the consumers at the point of purchase and may serve as a barrier to choose sustainable products and services (Shao, 2016).

3. QR codes as a tool for information provision

The extant literature suggests that sustainable consumption behaviour can be promoted by marketing innovations that can provide relevant and user-friendly sustainability-related product information to consumers (Fiore et al., 2017). Such innovations can offer easy access to information about a product's relevant sustainability characteristics. It can thereby enable consumers to make comparisons between products and encourage choices based on the social and environmental concerns and the preferences of consumers (Shao, 2016; Napolitano et al., 2010). This demand is also widely expressed by consumers themselves (Shao and Ünal, 2019; Grunert et al., 2014).

Mobile marketing is considered a useful tool for effectively disseminating sustainability information (Atkinson, 2013). Mobile marketing is defined as "a set of practices that enables organisations to communicate and engage with their audience in an interactive and relevant manner through any mobile device or network" (Mobile Marketing Association, 2009). Due to people's increasing reliance on mobile devices for navigating everyday life, there is potential for leveraging various marketing innovations on such devices (e.g., smartphones) for communication (Yang et al., 2013).

QR codes are one of the mobile applications with the potential to offer consumers smart and convenient information search while shopping (Ryu and Murdock, 2013). They can enhance consumer confidence with detailed and context-specific product information in a simple and streamlined process (Okazaki and Barwise, 2011). As such, they can offer information beyond what is communicated through other solutions, such as eco-labels, which are widely criticised for being superficial, misleading, or lacking credibility (Atkinson, 2013).

The potential of conveying sustainability information through QR codes is perhaps particularly relevant for so-called green or ethical consumers, who tend to seek and rely on such information when making purchase decisions (Atkinson, 2013). For instance, surveys suggest that consumers believe that the information provided by QR codes at the point of purchase offers them immediate, relevant, and useful messages that can inform purchase decisions and clarify corporate claims of sustainability (Atkinson, 2013). On the one hand, there is more widespread use of QR codes for communication with consumers in consumer goods and retail (Ryu and Murdock, 2013). On the other hand, there is also scepticism towards their effectiveness and actual use by consumers (e.g. Pozin, 2012). While existing research has investigated the potential of QR codes being adopted by consumers from various cognitive and design perspectives (e.g. Kim and Woo, 2016; Okazaki et al., 2019), there is a lack of evidence on actual consumer acceptance and use in real-life settings (Okazaki et al., 2019).

Against this backdrop, Orkla, one of Norway's largest FMCG companies, desired to overcome the challenge of communicating sustainability-related product information to its customers. To address this challenge, I collaborated with the company to study the efficacy of

QR codes to communicate sustainability-related product information in FMCG – specifically investigating consumers' inclination to scan QR codes on various products. In the next section, I introduce Study 1, in which I investigate various psychological and contextual factors that may affect the use of QR codes by consumers.

4. Study 1

4.1. Aim and conceptual framework

The purpose of Study 1 is to identify behavioural factors that affect consumers' intention to scan a QR code. In doing so, Study 1 aims to shed light on the characteristics of QR codes that co-determine the likelihood that they will be scanned by consumers.

In Study 1, I take the Technology Acceptance Model (TAM) as a starting point for investigating factors that affect consumers' scan intention of QR codes. TAM has been widely used as a framework to assess the determinants of users' acceptance of technology (Davis et al., 1989). It is a psychometric tool that allows the measurement of users' intention to use a technology through their attitude, which is determined by the perceived ease of use and usefulness of the technology (Kim and Woo, 2016; Venkatesh and Davis, 1996). Previous studies of QR code efficacy have also utilised TAM to investigate consumers' acceptance of QR codes. However, it is unclear to which degree these studies are relevant for green consumer behaviours (e.g. Kim and Woo, 2016). Due to differences in purchasing behaviours for sustainable products and services, there is a need for studying the efficacy of QR codes specifically for such products and services (Dangelico and Vocelleli, 2017; Peattie, 2001).

Study 1 comprises an online survey based on TAM and related behavioural factors that influence the acceptance of new technologies. This framework is visualised in Fig. 2, and shows how perceived usefulness and perceived ease of use determines the consumers' attitude towards a QR code, which in turn influences the behavioural intention to use QR codes, i.e. the consumer's *scan intention* (see Fig. 2 and Table A.1 in the Appendix for the survey instrument).

In addition to the variables of the TAM, Study 1 also measures other behavioural factors that may influence consumers' intention to use QR codes for accessing sustainability-related product information. For instance, prior studies on eco-labels (e.g. Van Loo et al., 2015) have argued that the extent of exposure to eco-labels relates to consumers' processing of information. Therefore, an important factor is which printable space on the product would give the best exposure for a QR code (Okazaki et al., 2019). Furthermore, visual characteristics, like colour use, may be important. It has been argued that the colour green has become so intertwined with environmental associations that the simple presence of green colour in product packaging can activate an environmental schema on the part of the consumer (Pancer et al., 2017). Thus, one variable in the framework investigates if visual appearance, specifically green colour with an environmental cue, increases scan intention.

Lastly, previous research shows that the consumers are likely to respond better to "pushy requests" in domains that they view as important, while they respond more favourably to suggestive appeals when they lack initial conviction (Kronrod et al., 2012). In light of this, a QR code can come with an assertive appeal (e.g. "Scan the QR code for sustainability information!") or it can have a more suggestive appeal for consumers to scan (e.g. "Please scan the QR code for sustainability information!"). The study investigates which type of messaging is more likely to be effective for QR codes. Table A.2 in the Appendix summarises the factors discussed above.

4.2. Data collection

A nationally representative survey was conducted in Norway through the data collection service-provider *Norstat*. In total, 250

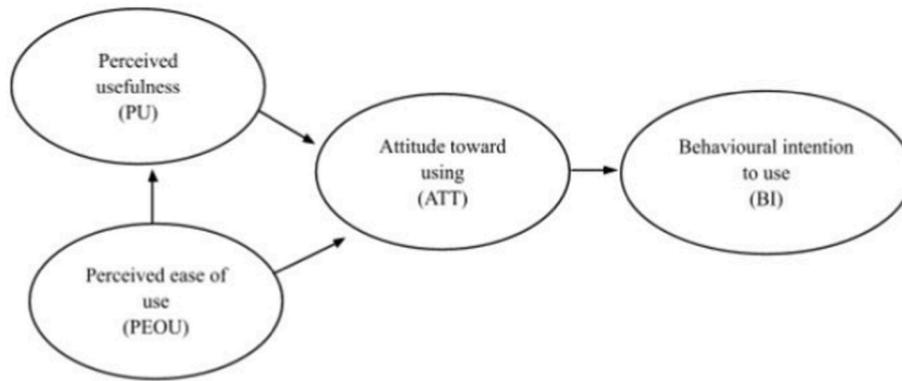


Fig. 2. The technology acceptance model (TAM) (based on Davis et al., 1989).

respondents, who were largely representative of the Norwegian adult population, responded to the survey. All items except demographic variables were measured on a Likert scale from 1 to 7.

4.3. Findings

The sample consisted of 54% female participants, and the average age in the sample was 38 years (SD = 12). Fig. 3 shows the coefficients for the variables in the model.

As shown in Table 1, all of the selected variables had statistically significant associations as well as goodness of fit (gfi) and comparative fit index (cfi) higher than 0.90. The results indicate that the respondents perceived QR codes as easy to use and useful, which translated into a positive attitude toward the technology. This, in turn, had a positive and statistically significant association with the behavioural intention to scan QR code.

Next, we turn to the investigation of visual or messaging preferences for QR codes, related to colour in the QR code design and assertive versus suggestive appeals in the messaging. The results showed that respondents were more favourable to scan a green-coloured QR code with an environmental cue than a standard black-and-white QR code. The difference was statistically significant (p < 0.001). Furthermore, respondents showed a preference for QR codes that came with an appeal to scan instead of QR codes without complementary text. This result was also statistically significant (p < 0.001). Tables 2 and 3 summarise these results.

With regard to the placement, the most preferred position for QR

Table 1
Summary Statistics of TAM determinants to scan intention.

Summary Statistics		
N = 250	coefficient	95% confidence interval
PEOU => PU	.59***	[0.506943, 0.683816]
PU => ATT	.63***	[0.5474176, 0.7135764]
PEOU => ATT	.35***	[0.2659699, 0.4439917]
ATT => BI	.87***	[0.836943, 0.9112576]
N = 250		
chi2_ms(72)		258.88
gfi		0.92
cfi		0.93
Standardised root mean squared residual (SRMR)		0.060

Note: ***p < 0.001; PEOU = Perceived ease of use; PU= Perceived usefulness; ATT = Attitude toward using (QR codes); BI = Behavioural Intention to use.

code was on the front of the product packaging (avg rank = 1.98) followed by the back of the packaging (avg rank = 2.13), the side of the packaging (avg rank = 2.69), and on the shelf (avg rank = 3.18) (see Fig. 4). The preference for QR code placement on the front of the package was significantly higher than for QR code placement on the side of packaging or on the shelf (p < 0.001, t = 6.89; p < 0.001, t = 11.00 respectively).

Overall, the findings of Study 1 showed that the behavioural factors from TAM are likely to affect consumers' intention to scan QR codes for accessing sustainability-related product information. In addition, the

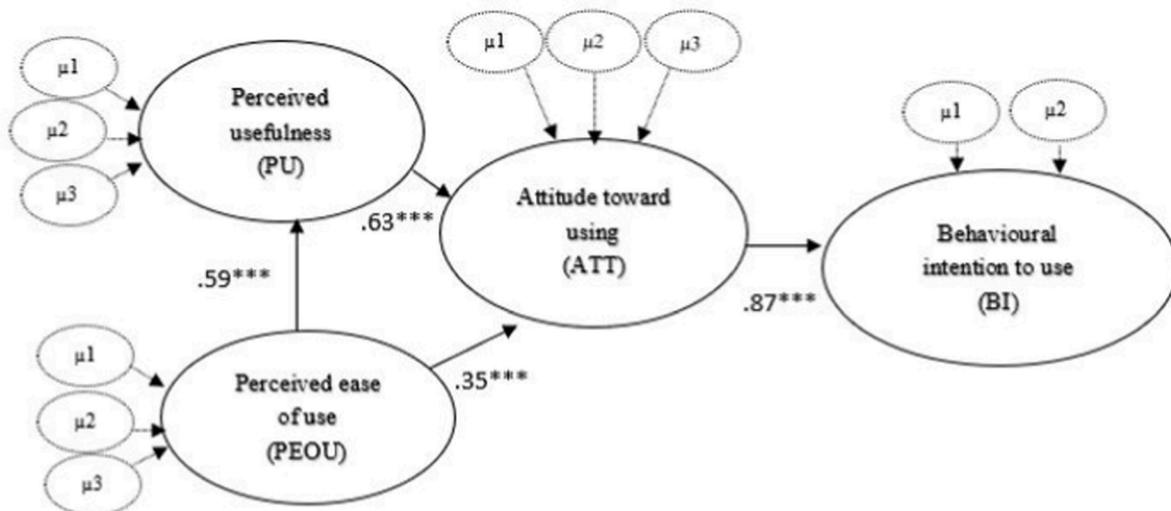


Fig. 3. Summary statistics.

Table 2
Summary statistics of the QR codes' visual appearance.

Summary Statistics				
Sr	QR Code	Mean likelihood for scan	Std Err.	95% CI
1	Standard QR Code 	3.53	.118	3.303724–3.760276
2	Green Coloured QR Code 	3.56	.115	3.333915–3.802085
3	Green Coloured QR Code with Environmental Cue 	4.05	1.88	3.817784–4.286216
	mean (diff) = mean (2 - 1)ho: mean(diff) = 0	.036	.090	-.1427376–.2147376 t = 0.39
	mean (diff) = mean (3 - 1)ho: mean(diff) = 0	.52***	1.628	.3171393 – t = .7228607 5.04

***p < 0.001, Score based on Likert scale 1 to 7: Higher mean score indicates higher likelihood for scan intention.

Table 3
Summary statistics on messaging appeals.

Brief Description of the Brands				
Sr	Messaging with QR Code	Mean likelihood for scan	Std Err.	95% CI
1	No message	3.13	.109	2.917168–3.346832
2	Suggestive message: "Is sustainability important to you? Scan to know more about the product." ^a	4.36	.113	4.140185–4.587815
3	Assertive message: "You should scan this and read sustainability info of the product!" ^b	4.28	.117	4.057142–4.518858
	mean (diff) = mean (2 - 1)ho: mean(diff) = 0	1.23***	.121	.9935368–1.470463 t = 10.17
	mean (diff) = mean (3 - 1)ho: mean(diff) = 0	1.15***	.127	.9047644 – t = 1.407236 9.062

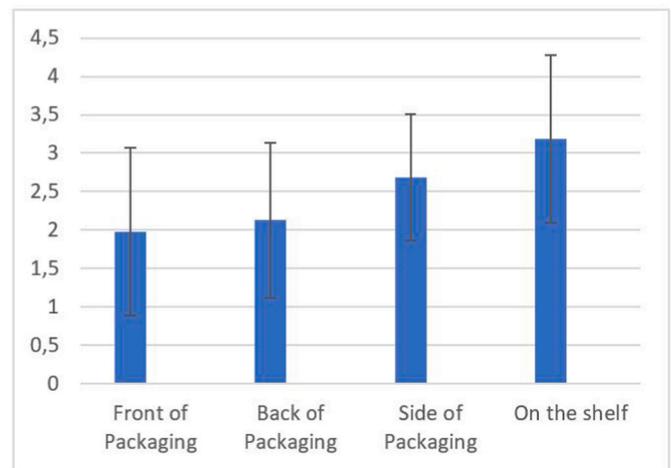
***p < 0.001, Score based on Likert scale 1 to 7: Higher mean score indicates higher likelihood for scan intention.

^a The original text in Norwegian reads as follows: "Er bærekraft viktig for deg? Skann for å få vite mer om produktet".

^b The original text in Norwegian reads as follows: "Skanne dette og les bærekraftsinformasjonen til produktet!"

findings revealed the stated preferences of consumers with regards to the visual appearance of the QR codes that include green environmental cues, an appeal to scan the QR code, as well as the placement of the QR codes. In terms of demographic variations, the results from Study 1 showed that women and people with a high level of education are more likely to believe that man-made climate change is a major problem. However, none of the demographic variables (age, education, and income level) were significant predictors of whether a person was likely to consider environmental concerns when shopping for everyday product and services (p > 0.10), although women showed higher intention to scan QR codes for sustainability-related information.

Study 1 thus offers important insights on factors that are likely to affect the use of QR codes. However, to investigate actual consumer behaviour in real life, an empirical investigation in the field is necessary. Therefore, in collaboration with the consumer goods company and its



Rank 1: Most preferred Rank 4: Least preferred

Fig. 4. Average rank on the preference for the QR placement.

retail partners in Norway, I study actual scanning behaviour in Study 2. The next section outlines this study.

5. Study 2

5.1. Aim and conceptual framework

While Study 1 reported on factors that affect consumers' intention to scan in a hypothetical survey setting, Study 2 investigates the actual scanning behaviour of QR codes by means of a field experiment in a retail setting.

Field experiments are considered essential for advancing knowledge on corporate sustainability in practice (Spicer et al., 2021). They can increase our understanding of the implementation of sustainability strategies and business models (Spicer et al., 2021). Field experiments in collaboration with businesses are regarded as a particularly attractive research methodology, as it provides a combination of control and realism usually not achieved in a lab (Levitt and List, 2009). While there are studies that have looked at consumer acceptance of QR codes (e.g. Kim and Woo, 2016; Ryu and Murdock, 2013), empirical insights into actual consumer behaviour are scarce (Okazaki et al., 2019). I therefore engaged in a collaborative effort with Orkla and its retail partners to conduct a field experiment on actual consumer behaviour in stores.

The findings of Study 1 of suggestive messaging were investigated further in the field experiment. Two types of QR codes were designed and distributed, and data on consumers' scanning behaviour for each of the two types was collected. In the following, I outline the data collection process and the findings of the experiment.

5.2. Data collection

Products with QR codes attached were distributed in October 2020 and I recorded scans on the QR codes until June 2021. The experiment was conducted in four supermarkets in the Coop and Meny supermarket chains in Oslo, the capital of Norway. The QR codes were designed on stickers that were pasted on the product packaging of three Orkla brands: Jordan, Toro and Möller's (see Table 4 for a description of each brand). Each brand represented a category of daily consumer goods – hygiene, food, and health and well-being, respectively. The chosen brands in this study are among the market leading brands in their respective product categories, and they are positioned to target the average Norwegian consumer. Furthermore, some promotional material

Table 4
Description of the brands utilised in the experiment.

Message Appeals	
Brand	Description
Toro	Toro offers products in the food category that include soups, sauces, chilled ready meals etc.
Jordan	Jordan is a brand of consumer goods in oral hygiene (e.g. toothbrush, dental floss etc). The company markets Jordan as an “environmentally friendly” brand.
Möller’s	Möller’s Tran is a cod liver oil that offers Omega-3 from fish and vitamins A, D and E.
–	–

was set up in the stores to inform customers about QR codes on products in the shops (see the Appendix). As mentioned above, the two types of QR codes were distributed across the different brands; one with a suggestive message to scan the QR code and one without any form of text (see Table 5). As the QR codes were attached to the products, consumers could scan the QR codes in the shop while purchasing or at home after the purchase. Once scanned with a smartphone, the QR codes redirected the user to a webpage that provided sustainability-related product information in Norwegian language (see the Appendix). The information covered topics such as certification, traceability, circularity, and so on. Furthermore, there was a brief survey with follow-up questions related to the usefulness of the QR codes as perceived by the consumers (see Table 6). The consumers were incentivized to respond to the survey by means of the opportunity to win gift cards through a lottery when conducting the survey.

5.3. Findings

A total of 3720 QR codes were distributed across the three brands and placed in the four stores. The overall scan percentage (i.e. conversion rate) was 4.22%; that is, 157 consumers scanned one of the QR codes. However, the QR codes placed on the Jordan and Möller’s brands had higher scan percentages than those on the Toro brand (see Fig. 5). Regarding the effectiveness of the different message appeals, the scan percentage for QR codes with a suggestive appeal was higher than that of QR codes without any appeal (see Fig. 5). Importantly, however, the difference was only statistically significant at the 90% confidence level ($p = 0.09$).

As outlined above, those who scanned the QR codes were redirected to a webpage where they were asked to respond to a brief survey on the use of QR codes for communicating sustainability-related product information. Of the 157 people, who scanned the QR codes, 18% people responded to the follow-up questions. The overall response was positive (see Fig. 6), with consumers giving high scores for the perceived usefulness of the QR codes, the perceived sustainability of the product and preference for the QR codes.

Table 5
Example of QR Codes used in the field experiment.

Follow-up User Survey		
Text Message with the QR code	QR Codes	English Description
No Appeal		
Suggestive Appeal	 <p>Er Möller’s tran et bærekraftig valg? SKANN FOR Å FINNE UT!</p>	Is Möller’s cod liver oil sustainable? Scan to find out!

Table 6
Follow-up questions on the QR codes.

Factor	Question ^a
Perceived Usefulness of the QR Codes	I found the information on this (QR Code) web page useful.
Perceived Sustainability of the product	Based on the information provided via QR code, I can say this product is sustainable.
Preference for the QR Codes	I hope more products will have a QR code with sustainability information in the future.
–	–

^a The questions were asked in Norwegian. The table provides the English translation thereof.

6. General discussion

Despite their increasing popularity, QR codes are an understudied topic in business research, especially from a sustainable consumption standpoint (Okazaki et al., 2019). Furthermore, the scant extant literature on this topic is based on either self-reported surveys or lab experiments, which are limited in their generalisability (e.g. Atkinson, 2013; Okazaki et al., 2019). The present research offers insights into factors that drive consumer acceptance of QR codes, specifically in the context of encouraging sustainable consumption, and the actual use of such QR codes in real-life settings.

The findings of Study 1 suggested that the perceived usefulness of sustainability information provided through QR codes and the perceived ease of use of the QR codes can positively increase the attitude toward using the technology. This is in turn likely to have a positive effect on the intention to scan. This result is consistent with the previous findings in the studies of QR codes (e.g. Kim and Woo, 2016). In a study based on student survey data, Ryu and Murdock (2013) utilised TAM and uses and gratification theory to study QR code scan intention. The results showed that perceived usefulness and perceived ease of use had a positive effect on the intention to scan, as well as other variables such as market mavenism and enjoyment (Ryu and Murdock, 2013).

The findings from Study 1 also revealed consumers’ preferences for the design and messaging aspects of QR codes. Respondents preferred QR codes with a visual environmental appeal. This aligns with the existing literature on the value of visual environmental cues on product packaging (cf. Pancer et al., 2017). The presence of such environmental cues has implications for consumers’ ability to categorise products as more or less environmentally friendly (Pancer et al., 2017). In the context of eco-labels, environmental cues used in isolation (i.e., a green colour without an environmental label or an environmental label without a green colour) have been associated with lower product efficacy (Pancer et al., 2017). The present study finds similar results. The respondents demonstrated a higher preference for green QR codes with an environmental cue, i.e. associated with environmental friendliness (cf. Lim et al., 2020).

Furthermore, prior studies suggest that assertively phrased requests typically decrease compliance with messaging compared to less-assertive phrases. However, according to Kronrod et al. (2012), the negative effect of message assertiveness on consumer compliance can be reduced or even reversed when the issue at hand is perceived as important by the target audience. In the present study, respondents had a clear preference for textual appeals accompanying the QR codes, but an assertive appeal compared to a suggestive appeal did not yield any negative effect on scanning intention. Regarding the knowledge gap on the optimal positioning of the QR codes on packaging (Okazaki et al., 2019), the findings in Study 1 suggested that respondents preferred QR codes to be placed on the front of the packaging.

Study 2 further investigated these findings in the field. There is scarce evidence on actual scanning behaviour, except a study by

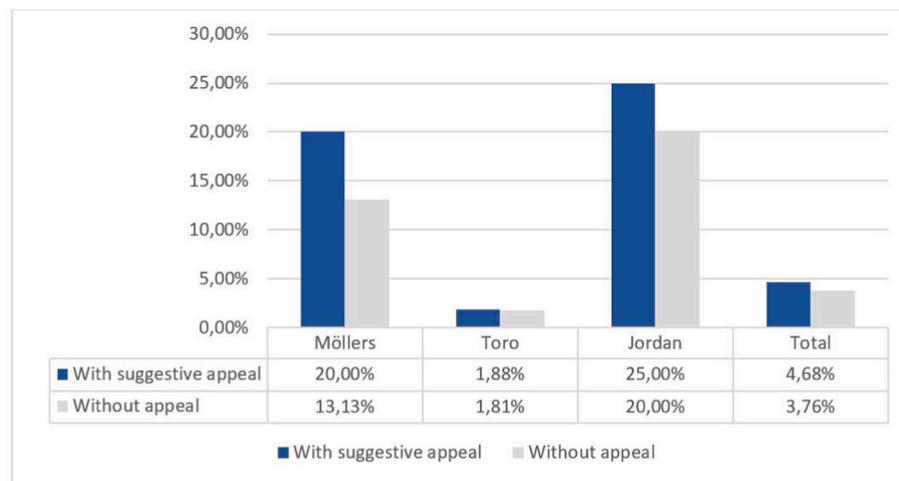


Fig. 5. Total Scans (% rate).

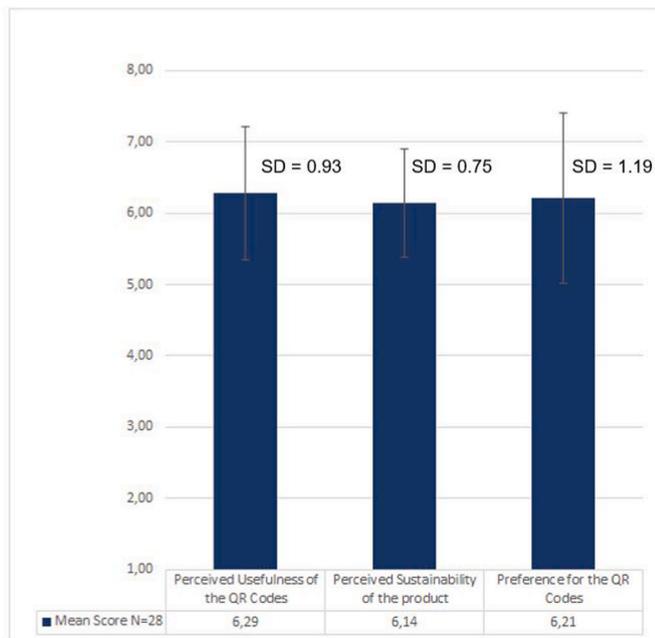


Fig. 6. Consumers' response to the QR codes on likert scale 1 to 7.

Vuksanović et al. (2020) based on self-reported data, which is not necessarily reliable (Kormos and Gifford, 2014). Vuksanović et al. (2020) investigated the use of QR codes among tourists to measure their satisfaction at a travel destination. Respondents widely used the QR codes, and the use of QR codes had a positive effect on transaction satisfaction, which positively influenced overall satisfaction (Vuksanović et al., 2020). Importantly, this self-reported data was mostly from a sample of people at the young age of 18–40, which limits its external validity. Other studies outside the field, i.e. in surveys or hypothetical lab settings, have showed consumers' positive attitude toward QR codes (e.g. Demir et al., 2015; Ertekin and Pelton, 2015). In light of this, Study 2 provided important new insights into actual scanning behaviour in a real-life setting.

The overall scan percentage in Study 2 was 4.22%, which is lower than the previously reported 6.2% scan percentage in a market survey (Comscore, 2011). Brand characteristics are, however, likely to influence the scan rate. For instance, Jordan had a higher scan percentage than that of other brands (e.g. Toro). Jordan is explicitly branded as a sustainable brand in the company's market communication. It is

possible that consumers who already have strong pro-environmental values are more likely to engage with this brand and the provided sustainability information (Grunert et al., 2014; Hoogland et al., 2007). Hence, this could be a potential explanation of the higher scan percentage for the Jordan products. However, the data in this study does not allow for drawing such inferences with certainty. The three brands – Jordan, Toro, Möller's – are also popular brands in their respective product categories. Therefore, they occupied prominently placed shelves in the stores, which is likely to contribute to higher consumer exposure to, and engagement with, the brands in the shopping setting. At the same time, Möller's is also likely to limit the consumer group by excluding vegan consumers. This is also likely to reduce the potential scan rate of the product, as extant research shows that the extent of environmental concerns is likely to correlate with vegan dietary preferences (Fox and Ward, 2008; Ploll and Stern, 2020).

The scan percentage with QR codes with a suggestive message appeal was higher than the scan percentage for QR codes without a suggestive appeal. However, the difference was only significant at the 10% level. Previous studies have established the value of message appeals (e.g. Kronrod et al., 2012) and the findings of Study 1 were also indicative that consumers would prefer such appeals. Future studies should build on these findings to provide further evidence on the effect of various message appeals on QR code scanning behaviour.

The present study investigates the acceptance and use of QR codes for the three product categories – food, hygiene and health. They are chosen because they represent some of the major product categories in everyday purchases. Such product categories have higher sales turnover, however, consumer decisions in these situations are largely habitual in comparison with durable items (e.g. electronics) (Verplanken and Wood, 2006). Hence, these products can be considered low-involvement goods that arouse lesser degree of consumer interest than that of high-involvement goods (Estelami and De Maeyer, 2004; Kuenzel and Musters, 2007; Mittal and Lee, 1989). In such cases, one can expect lower scan rate for these products in comparison with that of high-involvement goods. For high-involvement goods, purchase decisions are often based on extensive information search and evaluation of alternatives (Atkinson and Rosenthal, 2014). In such cases, consumers may avoid products if sustainability-related product information is lacking (Meise et al., 2014).

7. Conclusion and implications

Facilitating sustainable consumption requires behavioural change on the part of numerous stakeholders, not at least consumers (White et al., 2019). A lack of sustainability-related product information at the point

of purchase is potentially a structural barrier to the uptake of sustainable products and services (Sachdeva et al., 2015; Shao, 2016). Increasing consumer awareness and influencing decision making through such information can be one path to promote sustainable behaviours; provided that the information meets the needs of consumers (Meise et al., 2014; Shao and Ünal, 2019; White et al., 2019). This paper shows the potential value of QR codes for such information provision.

QR codes have witnessed a surge in popularity since 2020 (Silverberg, 2021). The Covid-19 pandemic have revitalised QR codes as a mode of communication, for instance because restaurants, cafes and other organisations have used them to convey covid-related information and to sell products and services in contactless ways (Gostin, 2021). However, businesses have been using them without much scholarly evidence to back their efficacy. There is a need for knowledge on how such QR codes can be used to promote societal benefits (e.g. product-related sustainability information that can stimulate sustainable consumption) as well as on QR code characteristics that will meet the needs of consumers. This paper contributes to these research gaps (Okazaki et al., 2019). The findings show that the perceived ease of use of QR codes and the perceived usefulness of the sustainability information provided through them are likely to have positive effects on consumer attitude and scan intention for the QR codes. Prominent placement on the packaging, presence of environmental cues and contextual information next to QR codes are also likely to encourage interaction. Furthermore, there has been a distinct lack of field studies on the value of such technology, and this paper contributes to the literature with novel insights into factors that determine consumer acceptance of QR codes in a real-life context (Okazaki et al., 2019).

The present study has valuable theoretical implications in this regard. The findings of the two studies extend our understanding of how consumers approach marketing innovations, in this case QR codes, in their decision making. It advances existing knowledge on the value of marketing innovations to promote sustainable consumption (Dangelico and Vocalelli, 2017; Gerstlberger et al., 2014; Peattie and Peattie, 2009). The paper moreover sheds light on the value of using factors from the Technology Acceptance Model for investigating user acceptance of QR codes, but at the same time acknowledges the limitations of the model by investigating additional factors that may affect scan intention (Hu et al., 1999). From a methodological standpoint, the paper also offers a rich combination of survey or experiment data from a lab setting with actual field-experimental data to reveal the determinants of consumer behaviour in real-life settings.

The findings have practical implications on two levels. At the micro-level, the findings suggest that companies that aim to use QR codes should consider redesigning their product packaging to highlight the sustainability characteristics of the QR codes through contextual information, placement, and environmental cues. On a broader level, the findings have implications for attempts to close the information gap that acts as one of the identified barriers to sustainable consumption (see e.g. White et al., 2019). For companies, policymakers, and other organisations alike, marketing innovations such as QR codes can serve as a tool for market communication. The present paper has implications for attempts to fill this information gap from entities that aim to do so, regarding message characteristics outlined above.

Finally, there is considerable urgency to act on reducing our environmental and social footprints and collaboration is considered a key to success (cf. SDG17; United Nations, 2021). The present studies shed light on the value of cross-sector collaboration between academia and businesses to conduct experimentation and testing in the field, when trying to design and implement solutions for more sustainable consumption.

8. Limitations and future research

In light of the findings of this paper, several avenues for future research have emerged. As described in the previous section, I do not

account for the sustainability characteristics of the brands in my experiment. This can be one explanation for divergence in the scan percentages between Jordan and the other brands. Future studies can further investigate how such brand characteristics interact with consumers' scan intentions and if certain consumer groups (e.g. vegans) are more or less likely to access sustainability information of products. Further research is also needed to understand how product characteristics affect scan intention. Using field experiments as an empirical strategy, future studies can compare consumers' scan intention for low-involvement products (e.g. grocery products) against scan intention for high-involvement products (e.g. consumer electronics, automobiles etc).

In the field experiment, it was not possible to collect socio-demographic data and control for it in the analyses. The findings from Study 1 suggest that demographic variables are not likely to influence whether an individual takes environmental concerns into account when shopping for everyday products. It is, however, still possible that demographic variables (such as age, education level, etc.) may have influenced consumers' inclination to scan QR codes. There is still a need for more field studies to investigate such relationships.

The findings of this paper are based on data on consumers in Norway. It should be noted that Norway, like other Nordic countries, is a highly digitalised society (Grym et al., 2018). Recent research also shows a higher level of awareness and preference for sustainable products among Nordic consumers (Bosona and Gebresenbet, 2018). Hence, it would be beneficial to supplement the findings of the present study with similar studies from other contexts that vary on these characteristics (e.g. emerging markets, countries with less mature digitalisation) for a more robust generalisation of the results.

The field experiment recorded the results for people who chose to scan the QR codes. However, it is quite possible that a significant number of people might have seen the QR codes but chose not to scan them. It is imperative to investigate possible factors or barriers that impede the consumers from scanning QR codes for accessing sustainability-related product information. Further research can take a more comprehensive approach by incorporating people who do not scan QR codes in the population sample and investigate further the barriers to adoption.

CRedit authorship contribution statement

Hussnain Bashir: Conceptualization, Methodology, Data curation, Formal analysis, Software, Writing – original draft, Writing – review & editing, This is to certify this is a single author manuscript. The following tasks were taken by the author.

Declaration of competing interest

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclepro.2022.132508>.

References

- Atkinson, L., 2013. Smart shoppers? Using QR codes and 'green' smartphone apps to mobilize sustainable consumption in the retail environment. *Int. J. Consum. Stud.* 37 (4), 387–393.
- Atkinson, L., Rosenthal, S., 2014. Signaling the green sell: the influence of eco-label source, argument specificity, and product involvement on consumer trust. *J. Advert.* 43 (1), 33–45.
- Bocken, N.M., Allwood, J.M., 2012. Strategies to reduce the carbon footprint of consumer goods by influencing stakeholders. *J. Clean. Prod.* 35, 118–129.
- Bosona, T., Gebresenbet, G., 2018. Swedish consumers' perception of food quality and sustainability in relation to organic food production. *Foods* 7 (4), 54.
- ComScore, 2011, August 12. 14 Million Americans Scanned QR Codes on Their Mobile Phones in June 2011. Comscore, Inc. Retrieved July 24, 2021. <https://www.comscore.com/Insights/Press-Releases/2011/8/14-Million-Americans-Scanned-QR-or-Bar-Codes-on-their-Mobile-Phones-in-June-2011>.
- Dangelico, R.M., Vocalelli, D., 2017. Green Marketing": an analysis of definitions, strategy steps, and tools through a systematic review of the literature. *J. Clean. Prod.* 165, 1263–1279.
- Davis, J.J., 1995. The effects of message framing on response to environmental communications. *Journal. Mass Commun. Q.* 72 (2), 285–299.
- Davis, F.D., Bagozzi, R.P., Warshaw, P.R., 1989. User acceptance of computer technology: a comparison of two theoretical models. *Manag. Sci.* 35 (8), 982–1003.
- De Pelsmacker, P., Driesen, L., Rayp, G., 2005. Do consumers care about ethics? Willingness to pay for fair-trade coffee. *J. Consum. Aff.* 39 (2), 363–385.
- Demir, S., Kaynak, R., Demir, K.A., 2015. Usage level and future intent of use of quick response (QR) codes for mobile marketing among college students in Turkey. *Proc. Soc. Behav. Sci.* 181, 405–413.
- Ertekin, S., Pelton, L.E., 2015. An exploratory study of consumer attitudes towards QR code reader applications. In: *Ideas in Marketing: Finding the New and Polishing the Old*. Springer, Cham, pp. 185–191.
- Estelami, H., De Maeyer, P., 2004. Product category determinants of price knowledge for durable consumer goods. *J. Retailing* 80 (2), 129–137.
- Fiore, M., Silvestri, R., Contò, F., Pellegrini, G., 2017. Understanding the relationship between green approach and marketing innovations tools in the wine sector. *J. Clean. Prod.* 142, 4085–4091.
- Fox, N., Ward, K., 2008. Health, ethics and environment: a qualitative study of vegetarian motivations. *Appetite* 50 (2–3), 422–429.
- Gerstlberger, W., Præst Knudsen, M., Stampe, I., 2014. Sustainable development strategies for product innovation and energy efficiency. *Bus. Strat. Environ.* 23 (2), 131–144.
- Gostin, I., 2021, March 25. How the Pandemic Saved the QR Code from Extinction. *Forbes*. Retrieved September 22, 2021, from. <https://www.forbes.com/sites/forbescommunicationscouncil/2021/03/25/how-the-pandemic-saved-the-qr-code-from-extinction/?sh=7dce57969056>.
- Grunert, K.G., Hieke, S., Wills, J., 2014. Sustainability labels on food products: consumer motivation, understanding and use. *Food Pol.* 44, 177–189.
- Grym, A., Koskinen, K., Manninen, O., 2018, May 23. Nordic Banks Go Digital. Retrieved from. <https://www.bofbulletin.fi/en/2018/2/nordic-banks-go-digital/>.
- Hardisty, D.J., Johnson, E.J., Weber, E.U., 2010. A dirty word or a dirty world? Attribute framing, political affiliation, and query theory. *Psychol. Sci.* 21 (1), 86–92.
- Hoogland, C.T., de Boer, J., Boersema, J.J., 2007. Food and sustainability: do consumers recognize, understand and value on-package information on production standards? *Appetite* 49 (1), 47–57.
- Hu, P.J., Chau, P.Y., Sheng, O.R.L., Tam, K.Y., 1999. Examining the technology acceptance model using physician acceptance of telemedicine technology. *J. Manag. Inf. Syst.* 16 (2), 91–112.
- Jaca, C., Prieto-Sandoval, V., Psomas, E.L., Ormazabal, M., 2018. What should consumer organizations do to drive environmental sustainability? *J. Clean. Prod.* 181, 201–208.
- Kim, Y.G., Woo, E., 2016. Consumer acceptance of a quick response (QR) code for the food traceability system: application of an extended technology acceptance model (TAM). *Food Res. Int.* 85, 266–272.
- Kormos, C., Gifford, R., 2014. The validity of self-report measures of proenvironmental behavior: a meta-analytic review. *J. Environ. Psychol.* 40, 359–371.
- Kronrod, A., Grinstein, A., Wathieu, L., 2012. Go green! Should environmental messages be so assertive? *J. Market.* 76 (1), 95–102.
- Kuenzel, J., Musters, P., 2007. Social interaction and low involvement products. *J. Bus. Res.* 60 (8), 876–883.
- Levitt, S.D., List, J.A., 2009. Field experiments in economics: the past, the present, and the future. *Eur. Econ. Rev.* 53 (1), 1–18.
- Lim, D., Baek, T.H., Yoon, S., Kim, Y., 2020. Colour effects in green advertising. *Int. J. Consum. Stud.* 44 (6), 552–562.
- Meise, J.N., Rudolph, T., Kenning, P., Phillips, D.M., 2014. Feed them facts: value perceptions and consumer use of sustainability-related product information. *J. Retailing Consum. Serv.* 21 (4), 510–519.
- Mittal, B., Lee, M.S., 1989. A causal model of consumer involvement. *J. Econ. Psychol.* 10 (3), 363–389.
- Marketing Association, Mobile, 2009. MMA Updates Definition of Mobile Marketing. Mobile Marketing Association, New York.
- Napolitano, F., Braghieri, A., Piasentier, E., Favotto, S., Naspetti, S., Zanoli, R., 2010. Effect of information about organic production on beef liking and consumer willingness to pay. *Food Qual. Prefer.* 21 (2), 207–212.
- Okazaki, S., Barwise, P., 2011. Has the time finally come for the medium of the future?: research on mobile advertising. *J. Advert. Res.* 51 (1 50th), 59–71. Anniversary Supplement).
- Okazaki, S., Navarro, A., Mukherji, P., Plangger, K., 2019. The curious versus the overwhelmed: factors influencing QR codes scan intention. *J. Bus. Res.* 99, 498–506.
- Pancer, E., McShane, L., Noseworthy, T.J., 2017. Isolated environmental cues and product efficacy penalties: the color green and eco-labels. *J. Bus. Ethics* 143 (1), 159–177.
- Peattie, K., 2001. Golden goose or wild goose? The hunt for the green consumer. *Bus. Strat. Environ.* 10 (4), 187–199.
- Peattie, K., Peattie, S., 2009. Social marketing: a pathway to consumption reduction? *J. Bus. Res.* 62 (2), 260–268.
- Ploll, U., Stern, T., 2020. From diet to behaviour: exploring environmental and animal-conscious behaviour among Austrian vegetarians and vegans. *Br. Food J.* 122 (11), 3249–3265.
- Pozin, I., 2012, March 8. Are QR codes dead?. *Forbes*. Retrieved September 22, 2021 from. <http://www.forbes.com/sites/ilyapozin/2012/03/08/are-qr-codes-dead/>.
- Rex, E., Baumann, H., 2007. Beyond ecolabels: what green marketing can learn from conventional marketing. *J. Clean. Prod.* 15 (6), 567–576.
- Ryu, J.S., Murdock, K., 2013. Consumer acceptance of mobile marketing communications using the QR code. *J. Direct, Data Digital Mark. Pract.* 15 (2), 111–124.
- Sachdeva, S., Jordan, J., Mazar, N., 2015. Green consumerism: moral motivations to a sustainable future. *Curr. Opin. Psychol.* 6, 60–65.
- Shao, J., 2016. Are present sustainability assessment approaches capable of promoting sustainable consumption? A cross-section review on information transferring approaches. *Sustain. Prod. Consum.* 7, 79–93.
- Shao, J., Taisch, M., Ortega-Mier, M., 2016. A grey-DEcision-MAking Trial and Evaluation Laboratory (DEMATEL) analysis on the barriers between environmentally friendly products and consumers: practitioners' viewpoints on the European automobile industry. *J. Clean. Prod.* 112, 3185–3194.
- Shao, J., Ünal, E., 2019. What do consumers value more in green purchasing? Assessing the sustainability practices from demand side of business. *J. Clean. Prod.* 209, 1473–1483.
- Silverberg, D., 2021, January 22. How Covid Turbocharged the QR Revolution. *BBC News*. Retrieved September 22, 2021, from. <https://www.bbc.com/news/business-55579480>.
- Spicer, A., Wagner, M., Zollo, M., 2021. Tinkering with the plumbing of sustainable enterprises: the case for field experimental research in corporate sustainability. *Organ. Environ.* 34 (3), 351–360.
- Tseng, S.C., Hung, S.W., 2013. A framework identifying the gaps between customers' expectations and their perceptions in green products. *J. Clean. Prod.* 59, 174–184.
- United Nations, 2021. The Sustainable Development Goals Report 2021. United Nations. Retrieved May 15, 2022, from. <https://unstats.un.org/sdgs/report/2021/>.
- Van Loo, E.J., Caputo, V., Nayga Jr., R.M., Seo, H.S., Zhang, B., Verbeke, W., 2015. Sustainability labels on coffee: consumer preferences, willingness-to-pay and visual attention to attributes. *Ecol. Econ.* 118, 215–225.
- Vega-Zamora, M., Torres-Ruiz, F.J., Parras-Rosa, M., 2019. Towards sustainable consumption: keys to communication for improving trust in organic foods. *J. Clean. Prod.* 216, 511–519.
- Venkatesh, V., Davis, F.D., 1996. A model of the antecedents of perceived ease of use: development and test. *Decis. Sci. J.* 27 (3), 451–481.
- Verplanken, B., Wood, W., 2006. Interventions to break and create consumer habits. *J. Publ. Pol. Market.* 25 (1), 90–103.
- Vuksanović, N., Bajrami, D.D., Petrović, M.D., Grigorieva, E.M., 2020. QR codes as a tool for receiving feedback about guests' satisfaction at destinations. *J. Place Manag. Dev.* 14 (1).
- White, K., Habib, R., Hardisty, D.J., 2019. How to SHIFT consumer behaviors to be more sustainable: a literature review and guiding framework. *J. Market.* 83 (3), 22–49.
- Yang, B., Kim, Y., Yoo, C., 2013. The integrated mobile advertising model: the effects of technology and emotion-based evaluations. *J. Bus. Res.* 66 (9), 1345–1352.
- Young, W., Hwang, K., McDonald, S., Oates, C.J., 2010. Sustainable consumption: green consumer behaviour when purchasing products. *Sustain. Dev.* 18 (1), 20–31.

CHAPTER IV

Pro-Environmental Behavioural Spillovers¹

ABSTRACT

Businesses must increasingly innovate in order to succeed with more sustainable business models. However, a significant proportion of the sustainability problem is argued to be attributable to unsustainable consumer choices. The question is how companies can facilitate sustainable consumer behaviour. The extant literature has shown that companies can do so with the help of behavioural interventions. However, recent literature in consumer psychology indicates that consumer behaviour is a more dynamic phenomenon than previously believed. Behaviours have lasting spillover effects and influence the likelihood that an individual will engage in certain future behaviours. This paper provides a theoretical overview of such behavioural spillovers and, through an online experiment (n = 405), demonstrates such behavioural spillovers in everyday consumption decisions.

¹ Extended English version of the article *Flere fluer i én smekk: Grønn dulting for bærekraftig kundeatferd* published in *Magma*, Issue 5 2021.

INTRODUCTION

Consumer behaviour is a fundamental element of sustainable development (Lehner et al., 2016). On one hand, tackling planetary and societal challenges requires product innovations, process innovations, and circular or sustainable business model designs (Bocken et al., 2016). On the other hand, the success of such strategies in terms of solving the sustainability problem increasingly depend on whether changes in public behaviour can and will complement available technical solutions (Lehner et al., 2016). Hence, behavioural insights are required for designing, implementing and evaluating policies that could help individuals make sustainable decisions (Lehner et al., 2016; Heiskanen et al., 2009; Wolff et al., 2011).

In this regard, several studies have investigated the use of behavioural interventions, such as “green nudges”, i.e., nudges that aim at promoting environmentally benign behaviour, to stimulate sustainable consumption (Thaler & Sunstein, 2009; Schubert, 2017). For example, “default choices” are widely used as behavioural interventions. This involves changing the standard choice that is made for individuals if they do not make an active choice themselves. For example, the default font is used by most Microsoft Word users and duplex printing is the default choice on most printers in order to reduce paper usage. Behavioural inertia prevents people from opting out of the standard choice (Kaiser et al., 2020). Another behavioural intervention is the use of socially normative messages. For instance, a message along the lines of “the majority of guests reuse their towels” has been shown to increase the reuse of towels, which reduces the number of washes (Goldstein et al., 2008). In the same way, behavioural intervention can be used as a demarketing or anti-marketing strategy. For example, smaller plates may be used in restaurant buffets to reduce food consumption and food waste (Kallbekken & Sælen, 2013; Soule & Reich, 2015).

The research on behavioural interventions and their subsequent effects on consumer choices mainly considers behaviour as a static, one-time phenomenon in the focal choice situation (see, e.g., Thaler & Sunstein, 2009; Lehner et al., 2016; Schubert, 2017). However, recent research in consumer psychology suggests that we should consider long-lasting and dynamic effects of past behaviours on future behaviours (Truelove et al., 2014; Lanzini & Thøgersen, 2014). These effects are called behavioural spillover effects (Truelove et al., 2014). This refers to scenarios in which a behaviour in one choice situation is transmitted to subsequent choice situations. Spillover effects can be both positive and negative. For instance, the need to maintain consistent behaviour can lead to one environmentally friendly action stimulating several environmentally friendly actions through positive spillover effects (Cialdini et al., 1995). Conversely, an

environmentally friendly choice in one situation may make an individual feel that he or she has a “licence” to act in less environmentally friendly ways in subsequent choice situations (Klößner et al., 2013). This is often called the “moral licensing” effect.

In this paper, I present the extant literature on both positive and negative spillover effects. Furthermore, using an online survey experiment (n = 405), I investigate how, subsequent to a behavioural intervention, a targeted pro-environmental behaviour (PEB) can affect a future non-targeted PEB. PEBs are those behaviours that leave a minimal footprint on the environment or, in some cases, may even benefit the environment (Steg & Vlek, 2009). In the experiment, the participants were exposed to the behavioural intervention – a “green nudge” – prior to being asked to choose between a green alternative and a non-green alternative. The findings show a spillover effect of the first PEB (green choice) on the second PEB (green choice). This is illustrated in Figure 1.

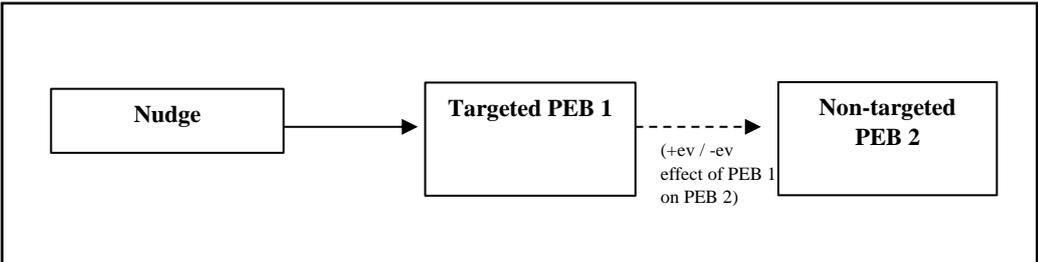


Figure 1: Visualization of spillovers

The findings have important implications for practice and for the advancement of theoretical knowledge on sustainable consumer behaviour. Successful transitions toward sustainable business models require sustainable consumption (Lehner et al., 2016). Both large companies and small enterprises are expected to offer innovative products that leave a small footprint on society and the environment. They are also expected to facilitate sustainable consumer behaviour (De Medeiros et al., 2014; Lehner et al., 2016). To succeed in this regard, companies need to consider the direct and indirect effects of behavioural interventions targeted at promoting sustainable consumer behaviour. Furthermore, to date, consumer behaviour has been understood as a static phenomenon. However, the findings presented here show the dynamic nature of that behaviour due to spillover effects. Consequently, there is a need for more knowledge about such behavioural spillovers and how different settings might introduce different types of spillovers (Maki et al., 2019). The goal is to design interventions such that

negative spillover effects are avoided and positive spillover effects are promoted in a wide range of choice settings (Henn et al., 2020). For businesses, especially small and medium-sized businesses, this would be especially useful, as it could shift customer behaviour in a more sustainable direction.

The remainder of the paper proceeds as follows. First, I review the extant literature on pro-environmental behavioural spillovers. Next, I outline the experimental study and its findings. Finally, I discuss the findings and their implications.

BEHAVIOURAL SPILLOVERS

A vast amount of research studies behavioural spillover effects in different contexts and demonstrates such effects as “a change in customers’ evaluation of one entity due to the evaluation of another entity” (Raufeisen et al., 2019, p. 250). For instance, the effect of reducing the use of plastic bags on overall recycling behaviour could be one example of spillovers for PEBs. The extant research looks at this spillover phenomenon from multiple angles and academics have categorised the spillovers into two broad types: positive and negative (Truelove et al., 2014). This section outlines these two types of spillovers, and explains mechanisms that may influence positive and negative PEB spillovers.

Positive spillovers

Spillovers are regarded as positive if the subsequent behaviour is consistent with the previous behaviour (Elf et al., 2019). For instance, the literature shows that recycling can lead to an avoidance of excess packaging as well as energy conservation, water conservation, composting and the use of reusable bags (Thøgersen, 1999; Berger, 1997). Similarly, research has shown that fuel-efficient driving can reduce the intention to consume meat (Van der Werff et al., 2014a).

One mechanism responsible for positive spillover effects is *consistency effects* (Truelove et al., 2014). In other words, people want to remain consistent in their behaviour (Festinger, 1957). This is similar to the *foot in the door* effect, which means that people are more likely to comply with more demanding requests subsequent to agreeing to a minor request (Ludwig & Geller, 1997; Freedman & Fraser, 1966). One way to support positive spillovers is through public commitment (Lokhorst et al., 2013) – that is, to make one’s intention to engage in green behaviour known to others. An example of positive spillovers through public commitment is

found in the study by Baca-Motes et al. (2013), which shows that hotel guests who openly commit to reusing towels are less likely to leave the lights on when they leave their hotel room.

Another mechanism that can explain positive spillover effects is the *identity effect* (Truelove et al., 2014). According to this effect, people who want to identify with a particular group or category of people will feel an inherent duty to act in line with the goals of that group (Truelove et al., 2014). If a person identifies as environmentally friendly, one PEB is likely to lead to positive spillover effects on future behaviours (Whitmarsh & O'Neill, 2010). Thus, by stimulating consumers' green identity, companies can promote PEBs among consumers along several behavioural dimensions (Truelove et al., 2014).

Research on positive spillover effects also shows that the probability of performing a green action is positively related to the probability of performing another green action in that "cluster" of related behaviours (Bratt, 1999). Hence, the categorisation of different types of behaviours in the mind of a consumer is also likely to influence the likelihood and direction of spillovers (Bratt, 1999).

Negative spillovers

Negative spillovers occur when a subsequent behaviour is not consistent with the previous behaviour. For instance, Tiefenbeck et al. (2013) show that the respondents exposed to an intervention designed to reduce their water consumption reduced their water consumption but increased their energy consumption. Such a behavioural intervention thus has a less desirable aggregate effect, as the overall effect of the two behavioural changes may be negative.

Academics have argued that the direction of spillover effects may be influenced by the motivation behind the action (Truelove et al., 2014; Elf et al., 2019). For example, negative spillover effects can occur when the initial behaviour is considered to be "too easy" and, thus, less of an expression of the individual's motivation to act "green" (Elf et al., 2019). *Moral licencing* is argued to be one mechanism for negative spillovers. It occurs when an individual feels entitled to engage in a non-environmentally friendly behaviour subsequent to a PEB (Blanken et al., 2015). For example, nudging people into giving a charitable donation can crowd out future pro-social acts because of moral licencing (Sachdeva et al., 2009).

Another mechanism that can explain negative behavioural spillovers is *rebound effects*. These effects occur, for instance, when financial savings as a result of one PEB are spent on a non-environmentally friendly behaviour (Elf et al., 2019). For example, if an eco-friendly product

becomes cheaper, consumers are more likely to choose it (direct effect). However, they simultaneously become more likely to consume it in excess quantities (rebound effect). This can have a net negative environmental impact because of the increase in total consumption. Finally, researchers have suggested that behavioural interventions inducing environmental action through guilt or fear are likely to produce negative spillovers, as the initial behaviour may not be a true representation of one's motivation (Truelove et al., 2014).

In summary, behavioural spillovers can amplify, eliminate or reverse the initial positive effect of a behavioural intervention (Truelove et al., 2014). Therefore, decision-makers who design such instruments should not only consider direct effects but also take any subsequent indirect effects into account. The next section presents an experimental study examining the presence of behavioural spillovers that affect consumers' future decisions.

EXPERIMENTAL STUDY

Aim

The experimental study is based on the use of identity-priming behavioural interventions to promote green consumer behaviour. This means raising the consumers' awareness of their own green identity. Research shows that labelling people who view themselves as environmentally friendly as *environmentalists* leads to increased identification with green behaviour (Lacasse, 2016). This can subsequently increase the likelihood of engaging in PEBs (Lacasse, 2016). Previous research also suggests that such interventions may have negative spillover effects (Fanghella et al., 2019; Tiefenbeck et al., 2013). Hence, the extant literature does not provide a conclusive perspective. Therefore, this experimental study aims to advance our understanding of behavioural spillovers in such settings.

Conceptual framework

Research suggests that motivation and commitment are important variables for the direction of spillover effects. People with a higher motivation to engage in a given behaviour have a lower probability of negative spillover effects (Truelove et al., 2014). Identity-based motivation theory indicates that an individual's perceived green identity influences that individual's motivation to engage in PEBs (Elf et al., 2019). Green identity correlates with green preferences, intentions and behaviours. Reminders of previous environmentally friendly behaviour can, thus, strengthen the individual's green self-identity, which can lead to

subsequent environmentally conscious behaviour (Van der Werff et al., 2014b). Moreover, Whitmarsh and O'Neill (2010) find that reminders of previous environmentally friendly behaviours lead to higher assessments of one's own green identity, which increases the likelihood of subsequent PEBs.

However, self-identity does not always stimulate more sustainable consumption (Fanghella et al., 2019). For instance, positive spillover effects may be absent if the individuals incur direct costs by acting in an environmentally friendly manner. Along these lines, Poortinga et al. (2013) find that people who pay a fee for plastic bags experience increased green identity, but that this does not lead to spillover effects. This may be because the behaviour is externally regulated through a fee and, therefore, does not evoke internal motivation (Elf et al., 2019).

One weakness in the behavioural spillover literature is that the studies are largely based on self-reported surveys, which makes the results less reliable (e.g., Lanzini & Thøgersen, 2014; Thomas et al., 2016; Elf et al., 2019). For instance, Elf et al. (2019) report spillover effects in consumer behaviour using self-reported change in behaviour in a given period. Studies based on such self-reported behaviour do not necessarily provide a reliable picture of actual behaviour, as individuals subconsciously state that they make better choices than they actually do to ensure social acceptance (Kormos & Gifford, 2014). Experimental studies can provide more accurate measurements of behavioural change as a result of behavioural spillovers (Truelove et al., 2014).

Experimental setting

The experiment in this study centred on identity priming as an intervention and investigated behavioural spillover effects, as shown in Figure 2. The experiment was based on a choice situation, such that the respondents were exposed to a behavioural intervention directed at the first PEB and subsequent spillover effects on the second PEB were captured.

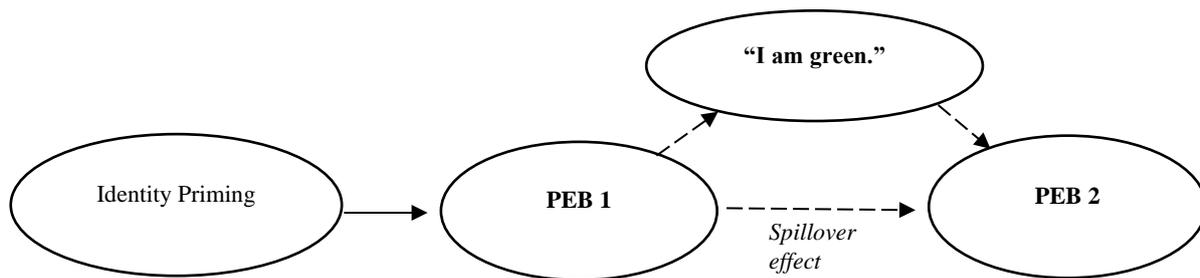


Figure 2: Behavioural spillovers from PEB 1 to PEB 2

The experiment was conducted online. In the first choice, all participants were presented with a situation in which they had to choose a meal for dinner. The alternatives were a vegetarian burger and a regular beef burger, where the choice of a vegetarian burger was the first PEB. The participants were then presented with a choice of French fries and drinks. These choices did not involve more or less green alternatives, but they worked as filler tasks, creating some time distance between the first and the second PEB. Finally, respondents were asked to choose a dish soap with which to wash their dishes after the meal. They could choose between an environmentally friendly soap or a high-strength soap, where the former was the second PEB. This choice can thus capture spillover effects from PEB 1 to PEB 2. Furthermore, the respondents belonging to the intervention group were reminded of their previous environmentally friendly actions before PEB 1. The aim of the identity-priming intervention was to increase the likelihood of the PEB in the first choice.

The experiment was conducted in November 2019 and was distributed by Norstat. A nationally representative sample of participants was recruited to participate in the experiment. The participants were divided into three groups. Participants in group 1 received the identity-priming intervention. Groups 2 and 3 were control groups. Participants in group 2 did not receive the identity-priming intervention but they answered the same questions as group 1. Group 3 was subjected to the same intervention as group 1 but was not presented with the first environmentally friendly alternative. Instead, they were asked to choose between a beef burger and a cheeseburger (the green choice was left out).

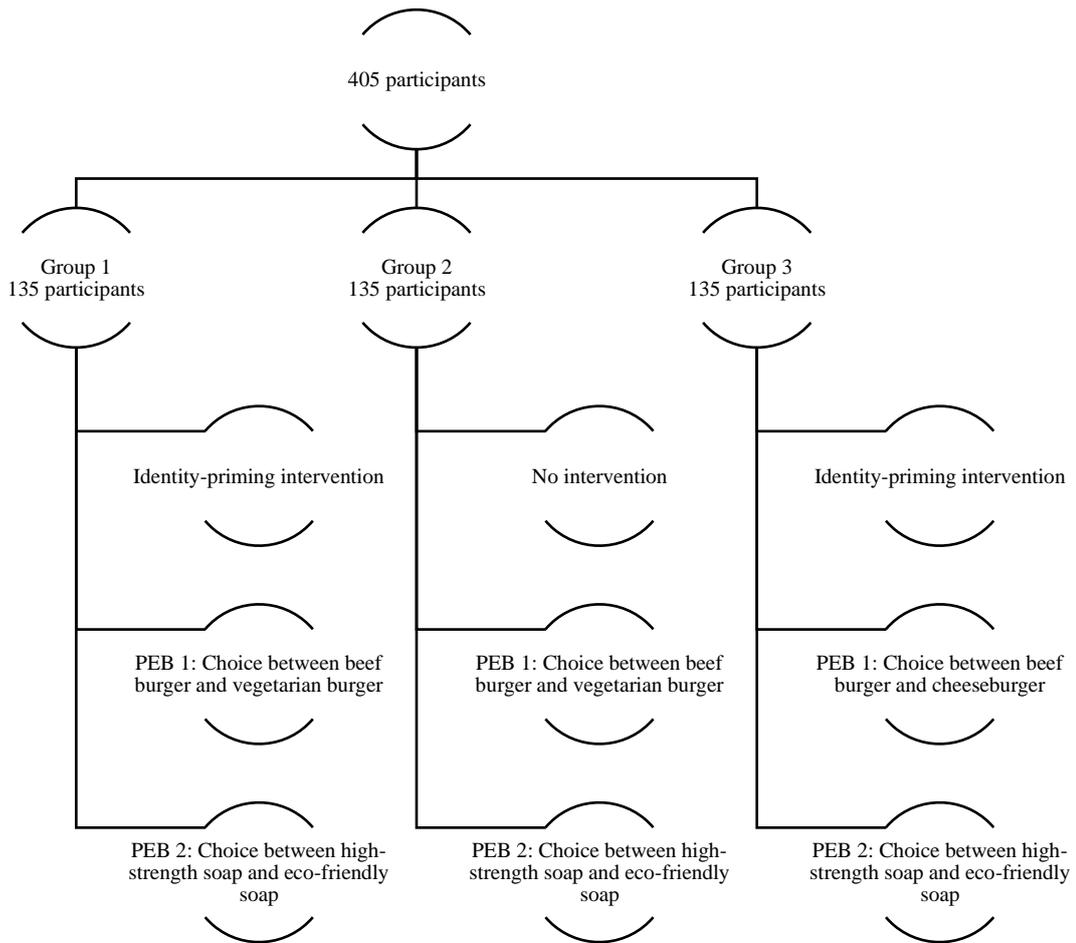


Figure 3: Experimental design

At the end of the experiment, the participants answered questions about their own perceived environmental profile. In other words, they were asked to assess their own perceptions and preferences with regard to sustainability. In this way, I controlled for participants with a stronger environmental profile, which has been shown to be important for consumer behaviour (Skard et al., 2020).

Findings

Of the participants, 53% were women. The average age of the participants was about 45 years (standard deviation = 17.68). Table 1 summarises the results of the experiment.

Table 1. Summary statistics

Group	Observations (N)			Mean score (PEB)			Mean score (choice of soap)		
	Total	F	M	Total	F	M	Total	F	M
Group 1	135	67	68	0.13	0.22	0.04	0.52	0.61	0.44
Group 2	135	79	56	0.19	0.21	0.16	0.61	0.63	0.59
Group 3	135	69	66				0.60	0.65	0.56

Table 1: Mean scores on PEBs for all participants (score = 1 indicates PEB)

When participants were exposed to identity priming, they were less likely to choose the environmentally friendly alternative in the first and second choice settings, as shown in Table 1. The effect was stronger among men than among women. However, the behavioural intervention did not have a statistically significant effect across the three groups (see Table 2). The participants in group 1 were less likely to engage in the first and the second PEBs compared to the control groups, but the result was not statistically significant ($p = 0.281$ and $p = 0.119$, respectively). This is in contrast to previous findings that identity priming increases the likelihood of green behaviour (Van der Werff et al., 2014b). Furthermore, the age of the participants was negatively associated with the tendency to engage in the PEBs – that is, younger people were more likely to adopt green behaviour. As expected, participants who scored high on the environmental-profile questions were also more likely to exhibit green behaviours. These results were statistically significant (see Table 2).

Table 2. Effect of identity priming

	(1)		(2)	
	PEB 1	Confidence interval	PEB 2	Confidence interval
Group 1	-0.0465	[-0.1312,0.0383]	-0.0931	[-0.2018,0.0155]
Enr Profile	0.0634***	[0.0331,0.0938]	0.1324***	[0.102,0.1630]
Age	-0.0040**	[-0.0064,-0.0016]	-0.0036**	[-0.0061,-0.0010]
Gender	0.0685	[-0.0179,0.1549]	0.0106	[-0.0807,0.102]
Group 3			-0.0073	[-0.1156,0.1010]
_cons	0.0691	[-0.1053,0.2434]	0.2244*	[0.0424,0.4063]
N	270		405	

95% confidence intervals in brackets.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Although the behavioural intervention did not have an effect on the first PEB, there were positive spillover effects from the first to the second PEB. Participants who chose the vegetarian burger (PEB 1) had a greater tendency to choose the environmentally friendly soap (PEB 2), regardless of whether they had been exposed to the behavioural intervention. This result was statistically significant ($n = 270$; see Table 3). This finding must be interpreted with caution, as it is possible that those who chose the vegetarian burger had a stronger environmental profile, and, thus, intuitively also chose the environmentally friendly soap. However, the result remained consistent after isolating for respondents with a lower environmental profile (less than the fiftieth percentile; $n = 67$). In other words, people were more likely to choose environmentally friendly soap if they first chose the vegetarian burger, regardless of their profile in terms of sustainable lifestyle. The effect was statistically significant and stronger in women than in men (see Table 3).

Table 3. Spillover effects (from PEB 1 to PEB 2)

	(1) ^a		(2) ^b		(3) ^c	
	PEB 2	Confidence interval	PEB 2	Confidence interval	PEB 2	Confidence interval
PEB 1	0.1696*	[0.0134,0.3259]	0.4708*	[0.0575,0.8842]	0.7301**	[0.1986,1.2616]
Enr Profile	0.1200***	[0.0796,0.1605]	0.1301*	[0.000574,0.2597]	0.1245	[-0.0735,0.3226]
Age	-0.0036*	[-0.0067,-0.0004]	-0.0053	[-0.0118,0.00104]	-0.00580	[-0.0155,0.00393]
Gender	0.0197	[-0.0925,0.1318]	0.0010	[-0.2195,0.2216]		
_cons	0.1953	[-0.0279,0.4186]	0.2254	[-0.1804,0.6314]	0.2306	[-0.3729,0.8342]
<i>N</i>	270		67		27	

95% confidence intervals in brackets.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

^a Spillovers from PEB 1 to PEB 2

^b Spillovers from PEB 1 to PEB 2 for participants with a lower environmental profile

^c Spillovers from PEB 1 to PEB 2 for female participants with a lower environmental profile

CONCLUSION AND IMPLICATIONS

The spillover effects of PEBs can have significant implications for businesses and policy makers with regards to encouraging consumers to choose more sustainable lifestyles. This article provides evidence of potential effects of behavioural spillovers on PEBs. However, the results also show that it is not easy to design and successfully implement behavioural interventions, even when potential spillover effects are taken into account.

On the one hand, the behavioural intervention in this study – identity priming - did not succeed in promoting participants' behaviour in the treatment group significantly pro-environmental than the participant's behaviour in the control group. A previous mediation analysis by Fanghella et al. (2019) showed that reminding people of their previous sustainable actions may create moral licensing effects that may lead them make less pro-environmental decisions. This could be one possible explanation for the fewer pro-environmental choices in the treatment group in this experiment. However, at the same time, the findings also show that the participants who behaved in a pro-environmental manner in the first choice were more likely to act pro-environmental in the second choice. This result remained consistent for participants with a low environmental profile and the effect was stronger for women. This finding may indicate that there is a consistency effect – in other words, participants want to act consistently with regard to the given PEBs (Truelove et al., 2014).

In this study, I have further investigated the possibility of creating positive spillover effects for sustainable consumption across decision-making situations. The study offers mixed results regarding the effects of identity priming. Van der Werff et al. (2014a, b) and Lacasse (2016) have shown that reminding a consumer of previous environmentally friendly behaviour can lead to a stronger perceived environmental profile and more environmentally friendly choices. The results in this study, on the other hand, are more in line with the findings of Fanghella et al. (2019), where the participants in the identity-priming group were less likely to act pro-environmentally than the participants in the control group. Although the findings of the experiment presented here do not unequivocally show that identity priming is effective in promoting green choices, they do demonstrate positive spillover effects from the first behaviour to the second. A recent study by Henn et al. (2020) showed that a change in attitude towards sustainable consumption can be a predictor of positive spillover effects. This suggests that policy instruments should be designed in a way that positively influences consumers' attitudes toward environmentally friendly behaviours, as doing so can promote PEBs across multiple choice settings. At the same time, spillover effects are a relatively new phenomenon in the literature. We can see anecdotal examples of spillover effects in everyday life, such as when it seems that someone is operating on moral licencing (e.g., when John Kerry flew to Iceland on a private jet to receive a climate award). Similarly, spillover effects can be seen at a more aggregate level in, for example, rebound effects between water and energy consumption (Baca-Motes et al., 2013; Thomas et al., 2016; Tiefenbeck et al., 2013). These are examples of how these effects manifest in daily life.

This study has investigated PEBs and their consequent spillovers in a hypothetical online setting. Hypothetical settings carry the risk that participants' behaviours may be influenced by the desire for social acceptance (Grimm, 2010). The literature lacks field studies and thorough evidence on this subject. Lab experiments, such as the one presented above, can be a good starting point for creating insights that can be further studied in the field across different contexts. Additional studies are also needed to investigate choice settings in which potential negative spillovers are more prevalent than potential positive spillovers. In addition, more research is needed on the mechanisms behind spillover effects, such as factors that mediate or moderate the direction and effect of those spillovers.

Nevertheless, the findings presented here contribute to a better understanding of PEBs and spillover effects. The study provides insights into the potential effects of identity priming, although the results indicate that further research into its effectiveness is required. Such priming

is already used in practice and the results of this study show that the decision-makers must treat such policy instruments with caution, as they can have unintended effects.

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REFERENCES

- Baca-Motes, K., Brown, A., Gneezy, A., Keenan, E. A. & Nelson, L. D. (2013). Commitment and behavior change: Evidence from the field. *Journal of Consumer Research*, 39(5), 1070–1084.
- Berger, I. E. (1997). The demographics of recycling and the structure of environmental behavior. *Environment and Behavior*, 29(4), 515–531.
- Blanken, I., van de Ven, N., & Zeelenberg, M. (2015). A meta-analytic review of moral licensing. *Personality and Social Psychology Bulletin*, 41(4), 540-558.
- Bocken, N. M., De Pauw, I., Bakker, C., & Van Der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308-320.
- Bratt, C. (1999). Consumers' environmental behavior: Generalized, sector-based, or compensatory? *Environment and Behavior*, 31(1), 28–44.
- Cialdini, R. B., Trost, M. R. & Newsom, J. T. (1995). Preference for consistency: The development of a valid measure and the discovery of surprising behavioral implications. *Journal of Personality and Social Psychology*, 69(2), 318.
- De Medeiros, J. F., Ribeiro, J. L. D. & Cortimiglia, M. N. (2014). Success factors for environmentally sustainable product innovation: A systematic literature review. *Journal of Cleaner Production*, 65, 76–86.
- Elf, P., Gatersleben, B. & Christie, I. (2019). Facilitating positive spillover effects: New insights from a mixed-methods approach exploring factors enabling people to live more sustainable lifestyles. *Frontiers in Psychology*, 9, 2699.
- Fanghella, V., d'Adda, G. & Tavoni, M. (2019). On the use of nudges to affect spillovers in environmental behaviors. *Frontiers in Psychology*, 10, 61.
- Festinger, L. (1957). *A theory of cognitive dissonance* (Vol. 2). Stanford University Press.
- Freedman, J. L. & Fraser, S. C. (1966). Compliance without pressure: The foot-in-the-door technique. *Journal of Personality and Social Psychology*, 4(2), 195.

- Goldstein, N. J., Cialdini, R. B. & Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research*, 35(3), 472–482.
- Grimm, P. (2010). Social desirability bias. I J. Sheth & N. Malhotra (Red.), *Wiley International Encyclopedia of Marketing*.
- Heiskanen, E., Brohmann, B., Fritsche, U. R., Schonherr, N., & Aalto, K. (2009). Policies to promote sustainable consumption: Framework for a future-oriented evaluation. *Progress in Industrial Ecology, An International Journal*, 6(4), 387-403.
- Henn, L., Otto, S. & Kaiser, F. G. (2020). Positive spillover: The result of attitude change. *Journal of Environmental Psychology*, 69, 101429.
- Kaiser, M., Bernauer, M., Sunstein, C. R. & Reisch, L. A. (2020). The power of green defaults: The impact of regional variation of opt-out tariffs on green energy demand in Germany. *Ecological Economics*, 174, 106685.
- Kallbekken, S. & Sælen, H. (2013). «Nudging» hotel guests to reduce food waste as a win–win environmental measure. *Economics Letters*, 119(3), 325–327.
- Klößner, C. A., Nayum, A. & Mehmetoglu, M. (2013). Positive and negative spillover effects from electric car purchase to car use. *Transportation Research Part D: Transport and Environment*, 21, 32–38.
- Kormos, C. & Gifford, R. (2014). The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology*, 40, 359–371.
- Lacasse, K. (2016). Don't be satisfied, identify! Strengthening positive spillover by connecting pro-environmental behaviors to an «environmentalist» label. *Journal of Environmental Psychology*, 48, 149–158.
- Lanzini, P. & Thøgersen, J. (2014). Behavioural spillover in the environmental domain: An intervention study. *Journal of Environmental Psychology*, 40, 381–390.
- Lehner, M., Mont, O. & Heiskanen, E. (2016). Nudging – A promising tool for sustainable consumption behaviour? *Journal of Cleaner Production*, 134, 166–177.

- Lokhorst, A. M., Werner, C., Staats, H., van Dijk, E. & Gale, J. L. (2013). Commitment and behavior change: A meta-analysis and critical review of commitment-making strategies in environmental research. *Environment and Behavior*, 45(1), 3–34.
- Ludwig, T. D. & Geller, E. S. (1997). Assigned versus participative goal setting and response generalization: Managing injury control among professional pizza deliverers. *Journal of Applied Psychology*, 82(2), 253–261.
- Maki, A., Carrico, A. R., Raimi, K. T., Truelove, H. B., Araujo, B. & Yeung, K. L. (2019). Meta-analysis of pro-environmental behaviour spillover. *Nature Sustainability*, 2(4), 307–315.
- Poortinga, W., Whitmarsh, L. & Suffolk, C. (2013). The introduction of a single-use carrier bag charge in Wales: Attitude change and behavioural spillover effects. *Journal of Environmental Psychology*, 36, 240–247. <https://doi.org/10.1016/j.jenvp.2013.09.001>
- Raufeisen, X., Wulf, L., Köcher, S., Faupel, U. & Holzmüller, H. H. (2019). Spillover effects in marketing: Integrating core research domains. *AMS Review*, 9(3–4), 249–267.
- Sachdeva, S., Iliev, R. & Medin, D. L. (2009). Sinning saints and saintly sinners: The paradox of moral self-regulation. *Psychological Science*, 20(4), 523–528.
- Schubert, C. (2017). Green nudges: Do they work? Are they ethical? *Ecological Economics*, 132, 329–342.
- Skard, S., Jørgensen, S. & Pedersen, L. J. T. (2020). When is sustainability a liability, and when is it an asset? Quality inferences for core and peripheral attributes. *Journal of Business Ethics*, 1–24.
- Soule, C. A. & Reich, B. J. (2015). Less is more: Is a green demarketing strategy sustainable? *Journal of Marketing Management*, 31(13–14), 1403–1427.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317.
- Thaler, R. H. & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness*. Penguin.
- Thomas, G. O., Poortinga, W. & Sautkina, E. (2016). The Welsh single-use carrier bag charge and behavioural spillover. *Journal of Environmental Psychology*, 47, 126–135.

- Thøgersen, J. (1999). Spillover processes in the development of a sustainable consumption pattern. *Journal of Economic Psychology*, 20(1), 53–81.
- Tiefenbeck, V., Staake, T., Roth, K. & Sachs, O. (2013). For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign. *Energy Policy*, 57, 160–171.
- Truelove, H. B., Carrico, A. R., Weber, E. U., Raimi, K. T. & Vandenberg, M. P. (2014). Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework. *Global Environmental Change*, 29, 127–138.
- Van der Werff, E., Steg, L. & Keizer, K. (2014a). I am what I am, by looking past the present: The influence of biospheric values and past behavior on environmental self-identity. *Environment and Behavior*, 46(5), 626–657.
- Van der Werff, E., Steg, L. & Keizer, K. (2014b). Follow the signal: When past pro-environmental actions signal who you are. *Journal of Environmental Psychology*, 40, 273–282.
- Whitmarsh, L. & O’Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, 30(3), 305–314.
- Wolff, F., & Schönherr, N. (2011). The impact evaluation of sustainable consumption policy instruments. *Journal of Consumer Policy*, 34(1), 43-66.

Behavioural Spillunders in Sustainable Investment Decisions

ABSTRACT

Sustainable investment is a key pillar of sustainable finance and plays an important role in sustainable development. In an attempt to understand the factors that may encourage sustainable investments, the extant literature has examined investor behaviour toward sustainable investments from multiple dimensions. However, we lack empirical research on how expectations of future behaviours, also referred to as “behavioural spillunders”, may influence sustainable investment behaviour. Using experiments as research methodology, this paper investigates the behavioural spillunder effects of expected future pro-environmental behaviours on investors’ intentions to invest sustainably at a given time. The findings from Study 1 (n = 201) suggest that investors who expect to make pro-environmental donations in the future are less likely to undertake sustainable investments today. However, this effect is not statistically significant. Study 2 introduces small potential costs for exhibiting pro-environmental behaviours. The findings from Study 2 (n = 295) suggest that investors who expect to voluntarily donate in the future are less likely to invest in sustainable investments today. The effect is statistically significant only for respondents who have a more favourable attitude toward donation. The findings indicate that the mere expectation of pro-environmental behaviours in the future can influence sustainable investment behaviour. At the same time, the paper highlights the limitations of lab experiments for studying the spillunder phenomenon and the need to advance the spillunder literature through natural field experiments.

INTRODUCTION

Sustainable investments (SI)² – that is, investments that take social, environmental or ethical concerns alongside financial returns into account – have become increasingly prevalent in financial markets (Hong & Kostovetsky, 2012; Renneboog et al., 2012). At the same time, the extant literature suggests that the popularity of non-sustainable stocks among investors has not shrunk, and these stocks still generate remarkable returns and outperform the market (e.g., S&P 500 Index) (Ghouma & Hewitt, 2019). There could be several reasons for this phenomenon. For instance, investors, especially retail investors, do not necessarily boycott sin companies. Instead, they may balance non-sustainability and sustainability with respect to companies' returns and ethics (Colonnello et al., 2019). It is also possible that investments in non-sustainable stocks could be a manifestation of complex consumer psychology.

The extant literature suggests that SI could be motivated by both pecuniary and non-pecuniary factors (Døskeland & Pedersen, 2016; Gutsche et al., 2016). Moreover, differences may exist among different groups or types of investors. For instance, while institutional investors may avoid investing in non-sustainable stocks because they are subject to social pressures arising from their public exposure, retail investors may not be subjected to such external scrutiny and, hence, may be more likely to hold these stocks for pecuniary reasons (Colonnello et al., 2019). In addition, despite the apparent interest in SI, private investors are likely to be cautious with SI due to the perception of high volatility within SI and their relatively short time horizon for investments (Paetzold & Busch, 2014).

Against this backdrop, studies have focused on behavioural aspects that might influence the demand for SI (e.g., Bassen et al., 2019; Brodback et al., 2019). However, these studies take behaviour as a static phenomenon, in contrast to recent studies in consumer psychology that suggest that pro-environmental consumption behaviour could have long-lasting cross-behavioural effects over time (Truelove et al., 2014). These phenomena are often referred to as pro-environmental behavioural (PEB) spillovers and spillunders (Truelove et al., 2014; Krpan et al., 2019). Thus, a key question is the following: Can SI in retail settings be influenced by PEB spillunders? In other words, can a retail investor's inclination to invest sustainably be

² Different terms are used to describe various types of such investments, including “socially responsible investments” (SRI), “responsible investments” (RI) and “ethical investments”. In this paper, I consistently use the term “sustainable investments” (SI) to refer to this broader category of investment behaviour, even in cases where I refer to papers that have used other terminology, such as “SRI”.

undermined by his or her expectation of adopting other PEBs in the future? This paper aims to answer this question.

PEB spillovers represent a change in a person's evaluation of a PEB subsequent to another PEB (Raufeisen et al., 2019; Truelove et al., 2014; Thøgersen & Crompton, 2009). Related to this phenomenon are behavioural spillovers in reverse or *behaviour spillunders*. This implies that the expectation of a behaviour influences the behaviour that precedes it (Krupan et al., 2019). The literature on behavioural spillunders is limited, especially with regard to spillunder effects on investment behaviour (Maki et al., 2019). Assuming that investors incorporate both pecuniary and sustainability-related concerns into their investment decisions (Anand & Cowton, 1993; Døskeland & Pedersen, 2019; Gutsche et al., 2016), the lack of literature and the importance of SI make it worthwhile to investigate whether expectations of future PEB could affect investors' utility functions and influence investment behaviour. This paper aims to contribute to this research gap by investigating potential PEB spillunders in SI decisions and the determinants thereof.

I conducted a combination of online lab experiments to investigate the effects of spillunders in an SI scenario. In two online experiments ($n = 201$ and $n = 295$), I analysed whether anticipation of PEB in the future (i.e., a donation to an environmental NGO) could influence the likelihood of PEB (i.e., investing in SI) in the present. The findings from the two studies reveal that investors who expect to engage in a PEB in the future (i.e., a donation) are less likely to invest in SI in the present. Importantly, however, the difference is not statistically significant. Furthermore, the findings of Study 2 suggest that a group of investors with more favourable attitude toward donation are less likely to invest in SI and this result is statistically significant. Overall, the two studies contribute to the growing literature on SI and how spillunder effects may influence this investment behaviour.

The remainder of this paper proceeds as follows. The next section first accounts for the extant research on SI behaviour, which is the behaviour under investigation. I then outline the phenomena of spillovers and spillunders, and their applications to SI. Thereafter, I present the experimental design and my methodological choices, while the subsequent section outlines the findings from the experiments. Finally, I discuss the findings in the light of the extant literature and outline potential policy implications and avenues for future research.

SUSTAINABLE INVESTMENT BEHAVIOUR

A vast body of literature investigates SI in one-off behaviour settings. For instance, Døskeland and Pedersen (2019) show that investors are motivated by pecuniary objectives in high-stakes situations, although the moral component is still relevant (Levitt and List 2007). Similarly, Colonnello et al. (2019) suggest that retail investors, who face less scrutiny, are pecuniarily motivated but balance their moral costs with perceived non-pecuniary benefits. Likewise, Glac (2009) suggests a higher impact of pecuniary gains in investment decisions. At the same time, a considerable stream of research shows the relevance of non-pecuniary motivations for SI, including psychological motives, values, norms, and feelings of a “warm glow” – the good feeling that is derived from the act of giving (Gutsche et al., 2016; Gutsche & Ziegler, 2019). Social preferences are likely to influence investors’ inclinations to invest sustainably (Bauer et al., 2021), and investors are likely to use their SI as for social signalling (Riedl & Smeets, 2017). Even so, under non-pecuniary motives, the retail demand for SI is highly sensitive to income shocks and has been shown to decrease when economies are hit hard (Döttling & Kim, 2021). Overall, the literature documents both pecuniary and non-pecuniary factors that may affect individuals’ inclinations to engage in SI.

Other studies have looked at various personal characteristics of investors that affect SI decisions. For instance, Brodback et al. (2019) suggest that personal values affect this inclination. Altruistic individuals are more likely to invest sustainably with non-pecuniary motivations, whereas individuals with egoistic values invest sustainably only for pecuniary reasons (Brodback et al., 2019). Similarly, Rossi et al. (2019) propose that social investors are motivated to invest sustainably for non-pecuniary reasons and that they are willing to pay a price for such investments. However, individuals with higher perceived financial literacy are less interested in SI (Rossi et al., 2019). Along the same lines, Døskeland and Pedersen (2019) show that financial arguments are more effective than moral arguments for high-wealth investors in decisions to invest sustainably. This effect is particularly high for the wealthiest investors. Gutsche and Ziegler (2019) argue that investors who derive high “warm glow” feelings from sustainable investments, feel an affinity with left-wing parties, and exhibit strong environmental awareness are more willing to sacrifice returns for the sustainability-related benefits associated with SI.

In summary, academic research on SI focuses on fund (or stock) performance, investor behaviour, investor types and characteristics, and so on (e.g., Bollen 2007; Kempf & Osthoff, 2007; Renneboog et al., 2008; Gutsche & Ziegler, 2019; Bassen et al., 2019; Brodback et al.,

2019; Døskeland & Pedersen, 2019). Researchers have looked at different pecuniary and non-pecuniary factors as well as investor characteristics that motivate SI. However, a common denominator in the extant literature is that these models investigate sustainable behaviour in investment decisions as a static phenomenon. There is consequently scarce insight into possible dynamics by which past (or future) behaviours influence SI decisions. This is problematic, as recent studies in consumer psychology shows that consumer behaviour is a dynamic phenomenon, and that it has lasting effects across time and context. These effects – often coined behavioural spillovers and spillunders – relate to how decisions may be shaped by past or future behaviours. Thus, in order to promote SI behaviour, they should be taken into account (Henn et al., 2020). In the following section, I account for the phenomena of spillovers and spillunders, and their applications to our understanding of SI behaviour.

SPILOVERS AND SPILLUNDERS

Spillovers can be the result of various phenomena, such as image transfer (i.e., the image or associations consumers hold for one object may be transferred to another object depending on multiple factors, including the nexus between the two objects; Smith, 2004). People are likely to transfer information, such as attributes, from one entity to an associated entity, which results in spillover effects (Raufeisen et al., 2019). Using a theoretical model developed by Raufeisen et al. (2019), spillovers can be explained in two steps:

Step 1: Cognitive association between two entities (e.g., two different PEBs).

Step 2: The transfer of attributes from one entity to another (e.g., from one PEB to the other).

A cognitive association between the two entities is essential for the occurrence of spillovers. Such an association can be the result of such factors as how individuals store information (associative network theory) or shared functional aspects (the contrast model) (Raufeisen et al., 2019). The second step requires the transfer of attributes from one entity to another, which could be the result of cognitive efficiency, a need for causation or a preference for cognitive harmony (Raufeisen et al., 2019).

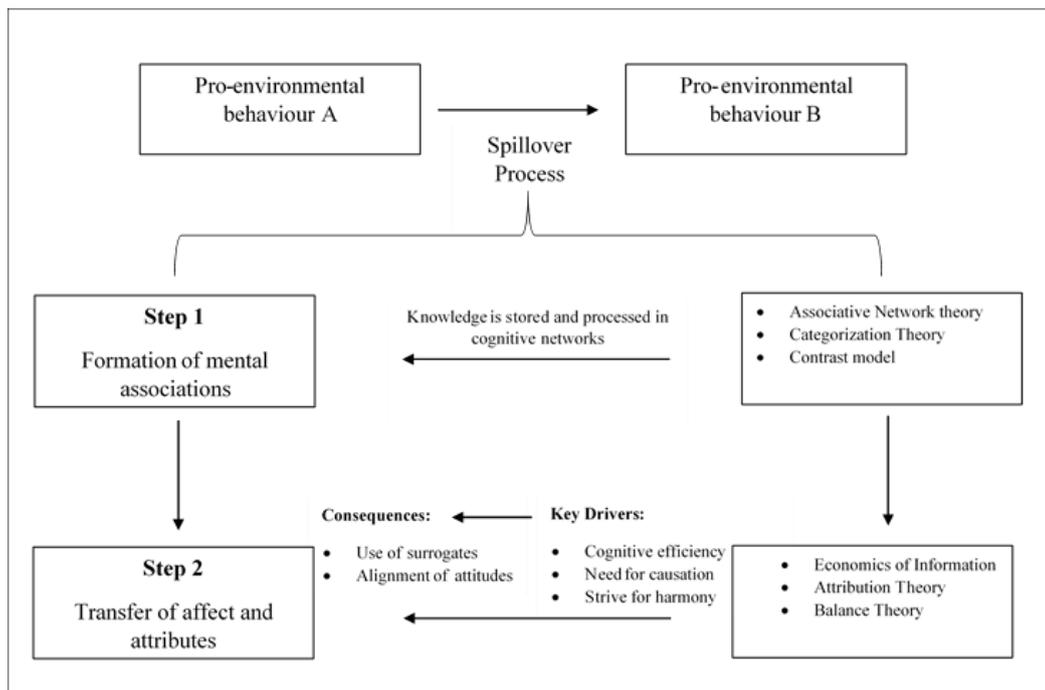


Figure 1: A theoretical model of spillover (cf. Raufeisen et al., 2019).

Figure 1 shows that for the two mentally connected entities (e.g., two PEBs), individuals store information in the form of associative networks that enable the transfer of attributes between the two entities. If a respective association exists, individuals are likely to align attitudes toward the two entities or use one as an information surrogate for the other. This process could be driven by cognitive efficiency, a need for causal explanations or preference for a harmonious state, thereby leading to spillover effects (Raufeisen et al., 2019). For instance, a person who has adopted one PEB (e.g., to be a conscious recycler of household waste) might associate this behaviour with other daily PEBs, such as using public transport or adopting a vegetarian lifestyle.

Spillovers are regarded as positive if the subsequent behaviour is consistent with the previous behaviour, while negative spillovers arise if the subsequent behaviour is not consistent with the previous behaviour (Elf et al., 2019). Negative spillovers are likely if the initial behaviour is deemed too easy and less representative of one's motivation (Elf et al., 2019). An example of negative spillover is an increase in energy use in response to a decrease in water use (Tiefenbeck et al., 2013). Moral licencing is argued to be another reason for negative spillovers. This occurs when an individual feels entitled to engage in a non-environmentally friendly behaviour subsequent to engaging in a PEB (Blanken et al., 2015). For example, nudging people into

giving charitable donations can crowd out future pro-social acts because of moral-licencing effects (Sachdeva et al., 2009). Rebound effects are another type of negative spillover. They occur when financial savings from one PEB are spent on a non-environmentally friendly behaviour (Elf et al., 2019). For instance, a person who saves money from not having a car (which benefits the environment) might choose to spend the saved amount on a flight to a summer destination. Thus, when a behavioural intervention induces a single PEB, the aggregate impact after accounting for spillover effects of that intervention may eliminate or even reverse the intervention’s initial positive effect (Truelove et al., 2014). Consequently, policy makers designing behavioural interventions to induce PEB should study not only their direct effects but also the aggregate effect after accounting for any spillovers.

Some studies have investigated spillover effects across different domains (Truelove et al., 2014; Maki et al., 2019). However, a common and predominant phenomenon, known as “spillovers in reverse”, is still understudied and lacks concrete empirical research (Krpan et al., 2019). “Spillovers in reverse” refers to the idea that the prospect of a future PEB could influence the likelihood of PEB in the present (see Figure 2). For example, an expectation of donating blood in the future may give an individual a “licence” to behave less ethically in the present (Cascio & Plant, 2015). This mirror image of behaviour spillovers is referred to as “behavioural spillunders” (Krpan et al., 2019).

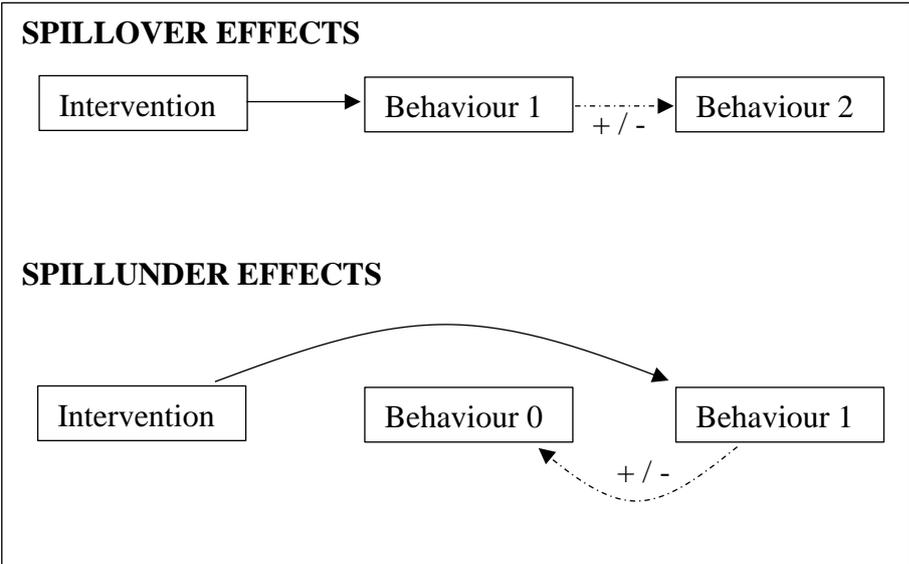


Figure 2: Visualization of spillunders (cf. Krpan et al., 2019)

A literature review by Krpan et al. (2019) shows that only a few articles have investigated the spillunder phenomenon thus far. However, none of them investigate spillunders for PEBs in general or for SI in particular. Furthermore, Krpan et al. (2019) argue that the existing theoretical models developed for the behavioural spillover phenomenon do not necessarily apply to spillunders. Instead, they categorise spillunder effects into two types of effects: “enhancing” and “extinguishing” spillunders, respectively. Enhancing spillunders are those spillunder effects in which the prospect of behaviour 1 could increase the likelihood or prevalence of behaviour 0. That is, the effect of the spillunder effect is largely positive. An example would be if the anticipation of acting in a pro-environmental manner tomorrow makes a PEB more likely today in order, for instance, to act consistently or in line with one’s identity. On the other hand, extinguishing spillunders are those spillunder effects in which the prospects of behaviour 1 could decrease the likelihood or prevalence of behaviour 0 (Krpan et al., 2019). This refers to situations in which the knowledge that one will act pro-environmentally tomorrow gives the individual “leeway” to act in an anti-environmental manner today. Such effects could be explained by psychological mechanisms, such as moral licensing, moral cleansing, emotion regulation, energisation, construal level, and savouring and dread (Krpan et al., 2019).

The empirical research on spillunders is limited (Krpan et al., 2019). I contribute to this literature by studying potential spillunder effects in the SI setting. In the following section, I outline the experimental design underlying the two empirical studies in this paper.

RESEARCH BACKGROUND

This paper uses an experimental research methodology to study potential behavioural spillunders in sustainable investment decisions. Experiments are a valuable and widely used empirical strategy for studying consumption practices and consumer psychology (Sawyer et al., 1979; Falk & Heckman, 2009). I adopted a lab-experimental approach based on two online survey experiments with the aim of demonstrating the effect of pro-environmental spillunders on retail investors’ inclinations to invest sustainably. I thus aim to contribute an understanding of the behavioural dynamics of investment behaviours that have so far been investigated as static individual decisions (e.g., Rossi et al., 2019; Døskeland & Pedersen, 2016; Webley et al., 2001; Statman, 2004; Beal et al., 2005).

From an empirical standpoint, the goal is to shed light on the potential influence of a PEB spillunder on SI behaviour – that is, whether the expectation of a future PEB influences the

decision to invest sustainably today. I built the experimental design on an intervention that induced anticipation of a future PEB – a donation to an environmental NGO. This allowed me to reveal whether such anticipation can influence an individual’s decision to invest sustainably in a preceding behaviour. Donations to environmental charities have previously been suggested to induce PEBs spillunders in experimental settings (Krpan et al., 2019). The two studies in this paper build on a similar treatment in which retail investors are exposed to a scenario including the anticipation of a donation to an environmental NGO in the future. Their investment behaviour (i.e., investing in an SI asset (stock or fund)) is then measured in the present time. In the following, I describe the two experimental studies in which these relationships are investigated.

STUDY 1

a) Aim and Sample

In Study 1, I designed an experimental study to investigate whether there are spillunder effects of an anticipated future donation to an environmental NGO (PEB 1) on retail investors’ inclination to invest sustainably today (PEB 0). I designed and conducted a randomised online survey experiment that was run by the Norwegian panel data service Norstat. I collected responses from 201 participants, who were largely representative of the Norwegian population on observable characteristics.

b) Experimental Setting

The participants in the experiment were exposed to a hypothetical scenario in which they had inherited a large sum of money (NOK 500,000; approximately USD 50,000). They were told that a stipulation of the inheritance was that they were required to invest the money for the long term. The participants were presented with a list of more and less sustainable mutual funds (see Table 1) and were asked to rank them in order of preference (1 = most preferred mutual fund, 4 = least preferred mutual fund). The two mutual funds classified as more sustainable represented the SI choice. Furthermore, as different retail investors may have different risk preferences, the investors had the option to choose more or less sustainable mutual funds with stable or volatile returns.

To investigate potential spillunder effects, half of the participants were randomised into a treatment group and informed that the inheritance also stipulated that they make a donation of

NOK 5,000 (approximately USD 500) to an environmental NGO fighting climate change. Importantly, this information was provided to participants in the treatment group before they were presented with the investment choice. In this way, they could anticipate the donation prior to making their investment decisions. The other half of the participants were randomised into the control group and they only received the information about the donation requirement after they had indicated their investment preferences. In addition to the ranking of mutual funds, variables pertaining to participants' demographics, environmental profiles, attitudes toward donation, attitudes toward SI, and social norms were measured and controlled for in the analysis (Ajzen, 1991). Table 1 covers the experimental design.

Table 1. Experimental design

Groups	Treatment	Mutual Funds
Group 1	Prior information on donation	Mutual fund A (not environmentally friendly, stable return)
Group 2	No prior information on donation	Mutual fund B (environmentally friendly, volatile return)
		Mutual fund C (environmentally friendly, stable return)
		Mutual fund D (not environmentally friendly, volatile return)

c) Empirical Findings

Of the participants (n = 201), 54% were female. The average age in the sample was 43 (standard deviation = 10.60). Overall, the subjects in the treatment group expressed less preference for SI than the participants in the control group (see Figure 3).

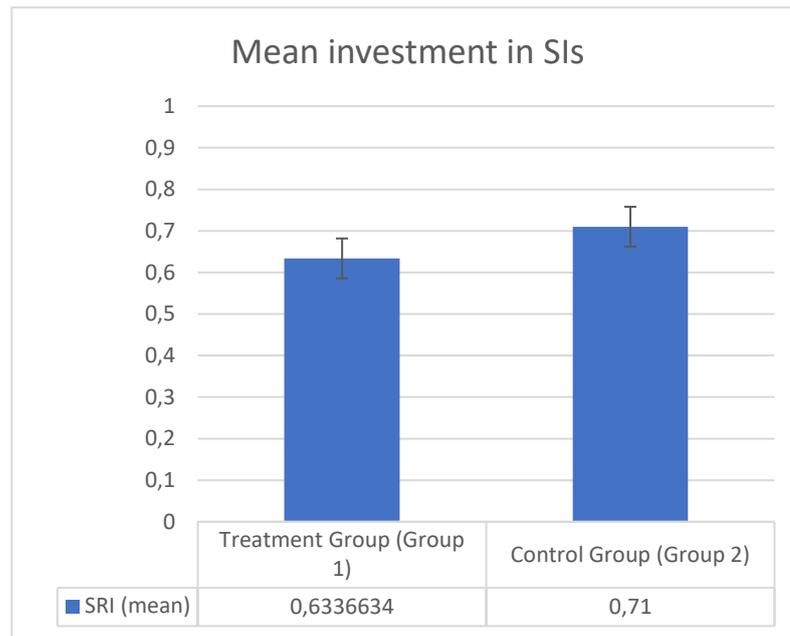


Figure 3: Average investment in SI for the two experimental groups

Overall, I found no statistically significant spillunder effect of the anticipation of the donation (PEB1) on the investment decision (PEB0) (see Table 2). Compared to the control group, the participants in the treatment group were less likely to prefer sustainable mutual funds over less sustainable funds. However, this preference was not statistically significant at the 95% confidence level. In terms of demographics, young participants and females were more likely prefer sustainable investments than older participants and men. Furthermore, perceived social norms in favour of SI positively influenced the inclination to invest sustainably ($p = 0.026$). However, participants' attitudes toward sustainability-related donations or SI were not significantly associated with their investment behaviours.

Table 2. Summary statistics

	SI	Confidence interval
Treatment Group	-0.0318863	[-0.14607, 0.0822974]
Age	-0.0069584*	[-0.012321, -0.0015959]
Gender	0.122506*	[0.0073846, 0.2376274]
Enr_profile	0.0126129	[-0.0386477, 0.0638734]
Attitude_donation	0.0081585	[-0.0003688, 0.0166857]
Attitude_SI	0.0005549	[-0.0102182, 0.011328]
Social_norms	.0568201*	[0.0067291, 0.106911]
_cons	0.3628384	[0.0189651, 0.7067118]
<i>N</i>	201	

Notes:

95% confidence intervals in brackets

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ Treatment = 1 for prior information on donation
Gender = 1 for male, = 2 for female

Attitude_donation – attitude toward environmental donations

Attitude_SI – attitude toward SI

Social_norms – perceived social norms on SI

Overall, the results of Study 1 were inconclusive. The experimental study failed to demonstrate a spillunder effect of the anticipated donation on the decision to invest sustainably. It is important to note that Study 1 was based on a purely hypothetical choice setting. In addition, the participants did not have any tangible incentives that could influence their investment decisions, which previous studies suggest may be important in such decisions. I therefore developed a second experimental study to rectify these shortcomings of Study 1's experimental design. I discuss the experimental design and results of Study 2 in the following section.

STUDY 2

a) Aim and Sample

As in Study 1, the aim of the second experiment was to investigate whether an anticipated future donation to an environmental NGO (PEB 1) has spillunder effects on retail investors' inclinations to invest sustainably in the present (PEB 0). The study was also conducted as an online survey experiment using a sample of business students ($n = 295$). Academics have argued that college students can be appropriate research subjects for gauging investor behaviour when the research emphasis is on underlying psychological processes, as in this case (Elliott et al., 2007; Kardes, 1996). The sample in this online experiment was mostly composed of bachelor's and master's students from a Norwegian business school.

b) Experimental Setting

The experimental setting was similar to Study 1. However, as noted above, I aimed to rectify the shortcomings related to the characteristics of the hypothetical scenario and the lack of incentives associated with the choice. In Study 2, the choice setting was simplified so that the participants had only two investment options: one sustainable stock and one less sustainable stock. The participants were informed that the sustainable stock had a historically lower rate of return than the less sustainable stock, but the same level of volatility and risk.

At the start of the experiment, the participants were given NOK 150 (approximately USD 15) to invest, and they could either invest in one of the two stocks or share it across the two stocks. They were informed that their returns would be based on computer-simulated stock performance for each of the stocks. Furthermore, they could choose to donate a small portion of their earnings (NOK 10; approximately USD 1) to an environmental NGO fighting climate change. The experiment was incentivised in the following manner: if a participant managed to keep their wealth of more than NOK 150 from their investment choices, they would be entered into a drawing in which they could win a BOSE headset (approximate value: USD 300). In this setting, participants who donated NOK 10 from their earnings incurred a cost that influenced their chances of winning the headset. If they believed that the sustainable investment had lower expected returns, this would add to their perception of reduced chances in the draw.

The participants were randomised into three experimental groups (see Table 3). Before making their investment decisions, participants in group 1 were told that NOK 10 would be deducted

from their earnings and donated to the environmental NGO. Thus, the donation was forced and pre-determined for group 1. Participants in group 2 were informed that they had an option to donate to the NGO before they made their investment decisions. In other words, they could voluntarily choose to donate to the environmental NGO. Participants in group 3 were given the option to donate to the environmental NGO after they had made their investment choice. In this way, the participants in groups 1 and 2 could anticipate the donation prior to their investment decision, while the participants in group 3 could not. Table 3 summarises this experimental design. In addition, similar to Study 1, variables concerning participants' environmental profiles, attitudes toward donation and SI, social norms and demographics were measured and controlled for in the analysis.

Table 3. Experimental setting

Groups	Intervention	Stocks
Group 1	Prior information on donation. Donation is forced.	Sustainable stock – SI (with historically low return)
Group 2	Prior information on donation. Donation is optional.	Less sustainable stock (with historically high return)
Group 3 (control group)	No prior information on donation.	

c) Empirical Findings

Of the participants ($n = 295$), 35% were female. The average age in the sample was 24 (standard deviation = 3.27). Overall, and as in Study 1, I found no statistically significant spillunder effect of the donation on the SI choice. However, when inspecting the investment behaviour of the experimental groups, several patterns emerged. In comparison with the control group (i.e.,

group 3), the participants in group 2 were more likely to invest in the less sustainable stock than the sustainable stock. However, this effect was not statistically significant (CI [-21.83, 2.203]; $p = 0.10$). This may be indicative of an extinguishing effect of the donation on the inclination to invest sustainably when a donation is voluntary. However, as these results are not statistically significant at 95% confidence level, they should be interpreted with caution (see Figure 4 and Table 4).

Interestingly, I find an inverse relationship between participants' attitude toward donations and their inclination to invest sustainably. In other words, a more positive attitude toward donations to an environmental NGO is negatively correlated with an inclination to invest sustainably. This effect is statistically significant ($p = 0.011$; see Table 4). This finding suggests that participants who expressed that protecting the environment was important to them and who felt that their donation could positively affect the environment were less likely to invest sustainably. To further probe this finding, I conducted additional analyses. A subsequent analysis showed that among participants with a more positive attitude toward the donation (the fiftieth percentile and above), the inclination to invest sustainably decreased when they were provided with prior information on the voluntary donation. This result was statistically significant ($p = 0.021$; CI [-25.66,-0.942]; $N = 139$; see Figure 5 and Table 4).

Other factors were also found to influence the inclination to invest sustainably. Participants with a stronger environmental profile were more inclined to engage in SI and the effect was statistically significant ($p = 0.0002$). Furthermore, participants who had a more positive attitude toward SI were more likely to invest sustainably. This result was also statistically significant ($p = 0.002$).

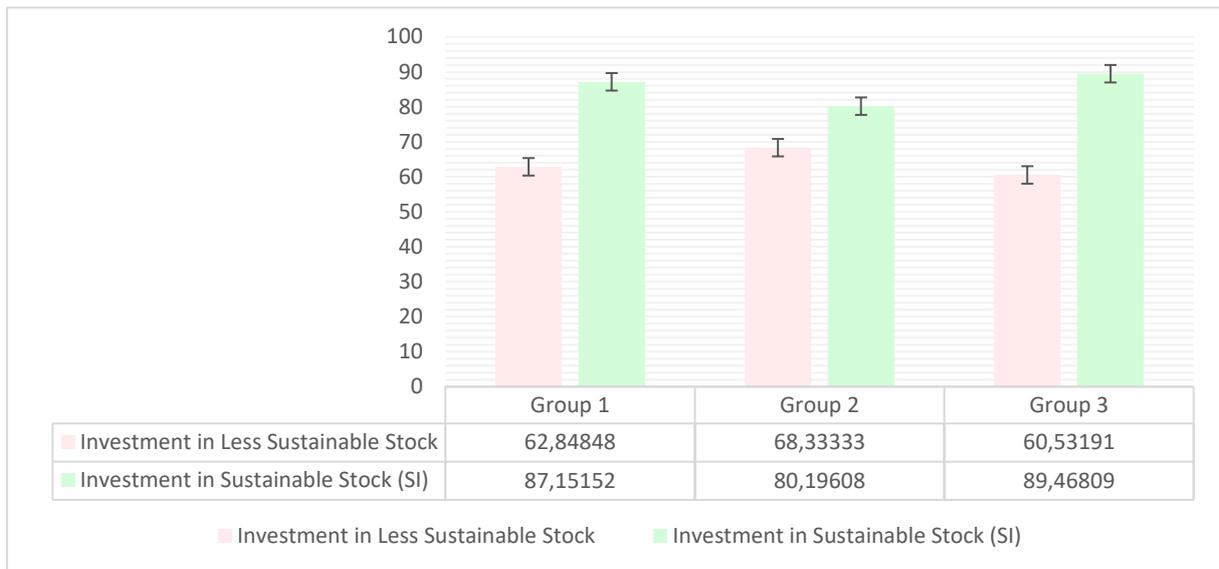


Figure 4: Avg. investment in the sustainable stock (SI) vs less sustainable stock across the three groups

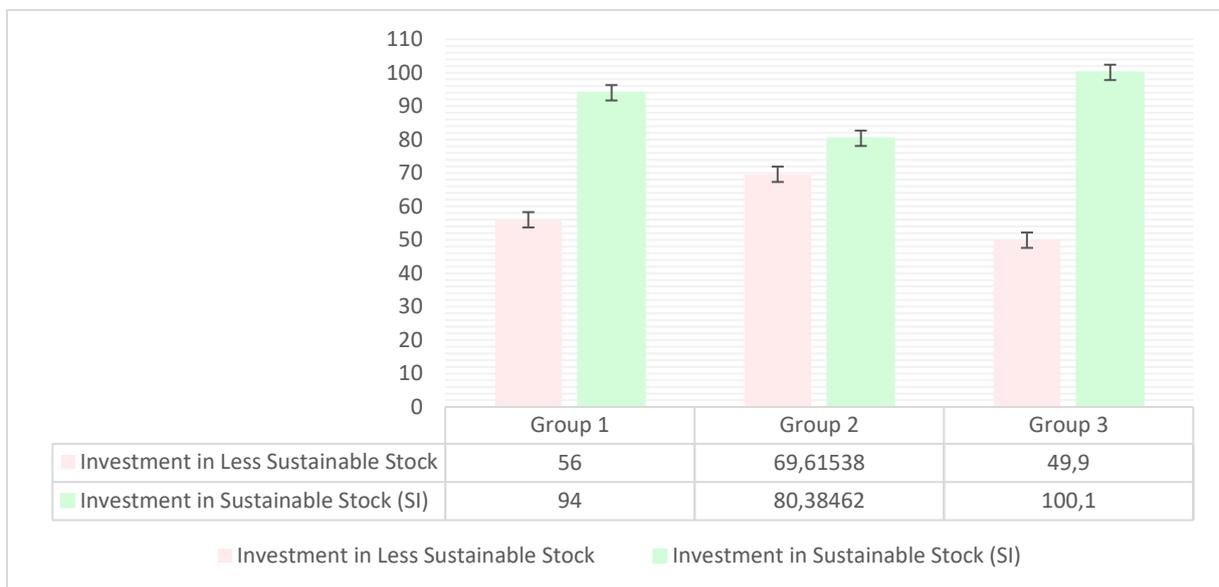


Figure 5: Average investment in sustainable versus less sustainable stock for respondents with a positive attitude toward donations

Table 4. Summary statistics

	SI	Confidence Interval	SI ^a	Confidence Interval
Group_1	0.566	[-11.55,12.68]	-0.179	[-16.05,15.69]
Group_2	-9.822	[-21.85,2.204]	-19.76*	[-36.47, -3.062]
Age	0.596	[-0.910,2.102]	1.345	[-0.756,3.447]
Gender	-4.217	[-14.73,6.300]	-2.692	[-16.59,11.20]
Enr_profile	8.391***	[3.904,12.88]	13.29***	[7.039,19.54]
Attitude_donation	-0.918*	[-1.627,-0.209]		
Attitude_SI	1.193**	[0.459,1.926]		
Social_norms	1.416	[-1.901,4.733]		
_cons	22.006	[-21.499,65.513]	-3.664	[-65.577,58.248]
<i>N</i>	295		139	

95% confidence intervals in brackets

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Group 1: Prior information on forced donation

Group 2: Prior information on optional donation

Group 3: No prior information on donation (control group)

^{a)} Investment in SI for attitude_donation > 50th Percentile

GENERAL DISCUSSION

A considerable stream of literature on SI accounts for both pecuniary and non-pecuniary motives for such investments (e.g., Brodback et al., 2019; Riedl & Smeets, 2017; Wins & Zwergel, 2016; Døskeland & Pedersen, 2016). Researchers have also argued that investors who have non-pecuniary motives to invest in sustainable stocks are willing to pay a price for such investment decisions (Belghitar et al., 2014). Gutsche and Ziegler (2019) argue that one non-pecuniary motive for SI is investors' desire to experience a "warm glow" (Andreoni, 1990). Such feelings can be a part of individuals' utility function for investing sustainably (Gutsche & Ziegler, 2019). However, a key question in this regard is how SI behaviour can be influenced if investors expect to receive feelings of warm glow from another source (e.g., a donation to an environmental NGO in the near future). This paper has attempted to investigate this question.

The findings of the two experimental studies were not conclusive in this regard. While the findings were not statistically significant, there were some indications that participants who expected to donate to an environmental NGO in the near future were less likely to invest sustainably today. A previous study by Meijers et al. (2015) suggested that people who donated to charities subsequently expressed lower intentions of engaging in other PEBs. Thus, the results in the present paper are more in line with those findings than the findings presented by

Riedl and Smeets, (2017) and Nilsson (2009), which show that people who are more charitable are also more likely to invest sustainably. A recent field experiment also suggested that people who are engaged in volunteer activities engage in SI significantly less (Gutsche et al., 2020). Finally, the present paper's findings concerning the effect of the individual's attitude toward SI are in line with previous findings indicating that people are more likely to engage in SI if they believe in the effectiveness of SI for environmental protection (Brodback et al., 2019).

I reiterate the need for caution when interpreting the findings presented here given the lack of statistical significance. Several factors are likely responsible for the lack of clear results that fit the theoretical framework presented in this paper. One factor potentially responsible for the lack of spillover effects can be the effortless nature of the two PEBs (i.e., donation and investment in SI; Fanghella et al., 2019). In Study 1, there is no cost of adopting a PEB, while in Study 2 there is a small potential cost associated with adopting a PEB. This could be one reason for the limited statistical significance for spillover effects in Study 2. Likewise, the phenomena of spillovers or spillunders are difficult to demonstrate, especially in a lab, and previous studies document a similar lack of statistically significant spillover effects (e.g., Fanghella et al., 2019; Ghesla et al., 2019). Moreover, this paper is based on studies conducted in a lab paradigm – past studies have raised concerns regarding the reliability of sustainable behaviour in such hypothetical choice settings (Brunen & Laubach, 2022). Thus, there is a need for additional research that investigates the conditions under which such effects may emerge. Such research may, for instance, investigate actual SI choices in field experiments (Bauer et al., 2021; Brunen & Laubach, 2022). I revisit the limitations of the studies in the next section.

To the extent that the results are suggestive of potential spillover effects, the patterns in the results of the two experimental studies are in line with “extinguishing” spillunders (cf. the Krpan et al., 2019, framework). This effect was demonstrated in one of the sub-analyses, which showed a significant association between participants' more positive attitudes toward donations' effectiveness and the spillover effect of anticipated donations on SI. Interestingly, the mere expectation of a future PEB – and not necessarily the adoption of the PEB itself – can influence the likelihood of engaging in a PEB at present. This is an important finding for the advancement of spillover research as well as for policy makers (Krpan et al., 2019). However, it needs to be interpreted carefully, as the main effect of intervention in both studies was statistically insignificant.

CONCLUSION AND LIMITATIONS

The present study has taken as its point of departure the call to adopt a dynamic perspective on sustainable consumption and behaviour patterns by investigating potential spillover effects on SI (Truelove et al., 2014). The rationale is that promoting or facilitating one behaviour without accounting for potential spillover or spillunder effects in other, related behaviours can have undesirable aggregate results (e.g., Chiou et al., 2011; Tiefenbeck et al., 2013; Hofmann et al., 2014; Cascio & Plant, 2015).

Crucially, the findings of the two experimental studies in this paper provide only limited evidence that such spillover effects occur in relation to SI behaviour. In two experiments, I investigated whether the mere anticipation of a PEB in the near future (in the form of a donation to an environmental NGO) influences retail investors' inclinations to invest sustainably in the present. Overall, the two studies do not demonstrate a significant main effect. In other words, the findings do not show spillunder effects of the future PEB (donation) on the present PEB (SI). A further inspection of the results based on additional analyses revealed that investors with a more positive attitude toward the effectiveness of donations were less inclined to invest sustainably. Beyond my analyses of potential spillunder effects, I found socio-demographic differences in the inclination to invest sustainability as well as significant associations between social norms for SI and investors' environmental profiles with regard to their inclination to invest sustainably.

The findings of this paper should be interpreted carefully due to limitations introduced by the experimental design. These shortcomings are also suggestive of potential avenues for future research that could be more successful in demonstrating spillunder effects in SI. I find limited evidence of spillunder effects, which may reflect the fact that such effects are a complex phenomenon and, in certain cases, the fact that the effects are small and weak (Maki et al., 2019). Furthermore, such effects are likely to be more observable when the two behaviours are closely related (Maki et al., 2019). There have also been questions regarding whether spillovers and spillunders are stable phenomena, and the extent to which they diminish with respect to the timespan between two behaviours in different contexts (Nilsson et al., 2017).

Importantly, given the hypothetical nature of the experimental setting, it might be that the participants in these experiments miscalculated the costs associated with donation in their investment decisions. This relates to salience theory, which suggests that participants' attention

is drawn to the salient attributes and that participants are likely to assign disproportionate weight to such attributes in a choice setting, such as the experiments presented in this paper (Bordalo et al., 2013). It is not clear whether individuals take their future donations or social charities into account in their investment decisions to the same extent as in these experiments, which could lead to underinvesting in the SI option. Moreover, the lack of realism in the scenario-based experiments implies that respondents may have felt the stakes were low (Levitt & List 2007). This might have been exacerbated by the lack of financial incentives for investing in Study 1 and the relatively small magnitude of incentives in Study 2. Finally, some participants might have overestimated their desire to engage in SI due to social-desirability bias (Grimm, 2010).

This discussion highlights several fruitful avenues for future research that could rectify these shortcomings. First, natural field experiments could be conducted to investigate this phenomenon in real-life settings, such as in the setting of an online bank (Truelove et al., 2014; Maki et al., 2019). An important benefit of such experiments would be that the sample would consist of actual retail investors. Even with other experimental designs, future research would benefit from the use of a sample of actual retail investors rather than a sample of the general population (Study 1) or a student sample (Study 2). This would yield insights related to a more relevant sample and strengthen the external validity of the investigation (Peterson & Merunka, 2014). Finally, future research could investigate PEBs other than donating to an NGO as the first behaviour that induces the potential spillunder effect.

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REFERENCES

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Anand, P., & Cowton, C. J. (1993). The ethical investor: Exploring dimensions of investment behaviour. *Journal of Economic Psychology*, 14(2), 377-385.
- Andreoni, J. (1990). Impure altruism and donations to public goods: A theory of warm-glow giving. *The Economic Journal*, 100(401), 464-477.
- Bassen, A., Gödker, K., Lüdeke-Freund, F., & Oll, J. (2019). Climate information in retail investors' decision-making: Evidence from a choice experiment. *Organization & Environment*, 32(1), 62-82.
- Bauer, R., Ruof, T., & Smeets, P. (2021). Get real! Individuals prefer more sustainable investments. *The Review of Financial Studies*, 34(8), 3976-4043.
- Beal, D. J., Goyen, M., & Philips, P. (2005). Why do we invest ethically?. *The Journal of Investing*, 14(3), 66-78.
- Belghitar, Y., Clark, E., & Deshmukh, N. (2014). Does it pay to be ethical? Evidence from the FTSE4Good. *Journal of Banking & Finance*, 47, 54-62.
- Blanken, I., van de Ven, N., & Zeelenberg, M. (2015). A meta-analytic review of moral licensing. *Personality and Social Psychology Bulletin*, 41(4), 540-558.
- Bollen, N. P. (2007). Mutual fund attributes and investor behavior. *Journal of Financial and Quantitative Analysis*, 683-708.
- Bordalo, P., Gennaioli, N., & Shleifer, A. (2013). Saliency and consumer choice. *Journal of Political Economy*, 121(5), 803-843.
- Brodback, D., Guenster, N., & Mezger, D. (2019). Altruism and egoism in investment decisions. *Review of Financial Economics*, 37(1), 118-148.
- Brunen, A. C., & Laubach, O. (2022). Do sustainable consumers prefer socially responsible investments? A study among the users of robo advisors. *Journal of Banking & Finance*, 136, 106314.

- Cascio, J., and Plant, E. A. (2015). Prospective moral licensing: does anticipating doing good later allow you to be bad now? *Journal of Experimental Social Psychology*, *56*, 110–116.
- Chiou, W. B., Yang, C. C., & Wan, C. S. (2011). Ironic effects of dietary supplementation: illusory invulnerability created by taking dietary supplements licenses health-risk behaviors. *Psychological Science*, *22*(8), 1081-1086.
- Colonnello, S., Curatola, G., & Gioffré, A. (2019). Pricing sin stocks: Ethical preference vs. risk aversion. *European Economic Review*, *118*, 69-100.
- Døskeland, T., & Pedersen, L. J. T. (2016). Investing with brain or heart? A field experiment on responsible investment. *Management Science*, *62*(6), 1632-1644.
- Døskeland, T., & Pedersen, L. J. T. (2019). Does wealth matter for responsible investment? Experimental evidence on the weighing of financial and moral arguments. *Business & Society*, 0007650319826231.
- Döttling, R., & Kim, S. (2021). Sustainability preferences under stress: Evidence from mutual fund flows during COVID-19. *Available at SSRN 3656756*.
- Elf, P., Gatersleben, B., & Christie, I. (2019). Facilitating positive spillover effects: New Insights from a mixed-Methods approach Exploring factors Enabling People to Live more Sustainable Lifestyles. *Frontiers in Psychology*, *9*, 2699.
- Elliott, W. B., Hodge, F. D., Kennedy, J. J., & Pronk, M. (2007). Are MBA students a good proxy for nonprofessional investors?. *The Accounting Review*, *82*(1), 139-168.
- Falk, A., & Heckman, J. J. (2009). Lab experiments are a major source of knowledge in the social sciences. *Science*, *326*(5952), 535-538.
- Fanghella, V., d'Adda, G. and Tavoni, M., 2019. On the use of nudges to affect spillovers in environmental behaviors. *Frontiers in Psychology*, *10*, 61.
- Ghesla, C., Grieder, M., & Schmitz, J. (2019). Nudge for good? Choice defaults and spillover effects. *Frontiers in Psychology*, *10*, 178.
- Ghouma, H. H., & Hewitt, C. S. (2019). Lobbying expenditures and sin stock market performance. *Research in International Business and Finance*, *49*, 176-190.

Glac, K. (2009). Understanding socially responsible investing: The effect of decision frames and trade-off options. *Journal of Business Ethics*, 87(1), 41-55.

Grimm, P. (2010). Social desirability bias. *Wiley International Encyclopedia of Marketing*.

Gutsche, G., Köbrich-León, A., & Ziegler, A. (2016). *On the relevance of psychological motives, values, and norms for socially responsible investments: An econometric analysis (No. 41-2016)*. MAGKS Joint Discussion Paper Series in Economics.

Gutsche, G., Wetzel, H., & Ziegler, A. (2020). *Determinants of individual sustainable investment behavior-A framed field experiment (No. 202033)*. Philipps-Universität Marburg, Faculty of Business Administration and Economics, Department of Economics (Volkswirtschaftliche Abteilung).

Gutsche, G., & Ziegler, A. (2019). Which private investors are willing to pay for sustainable investments? Empirical evidence from stated choice experiments. *Journal of Banking & Finance*, 102, 193-214.

Henn, L., Otto, S., & Kaiser, F. G. (2020). Positive spillover: The result of attitude change. *Journal of Environmental Psychology*, 101429.

Hofmann, W., Wisneski, D. C., Brandt, M. J., and Skitka, L. J. (2014). Morality in everyday life. *Science* 345, 1340–1343.

Hong, H., & Kostovetsky, L. (2012). Red and blue investing: Values and finance. *Journal of Financial Economics*, 103(1), 1-19.

Kardes, F. R. (1996). In defense of experimental consumer psychology. *Journal of Consumer Psychology*, 5(3), 279-296.

Kempf, A., & Osthoff, P. (2007). The effect of socially responsible investing on portfolio performance. *European Financial Management*, 13(5), 908-922.

Krpan, D., Galizzi, M. M., & Dolan, P. (2019). Looking at Spillovers in the Mirror: Making a Case for “Behavioral Spillunders”. *Frontiers in Psychology*, 10, 1142.

Levitt, S. D., & List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world?. *Journal of Economic Perspectives*, 21(2), 153-174.

- Maki, A., Carrico, A. R., Raimi, K. T., Truelove, H. B., Araujo, B., & Yeung, K. L. (2019). Meta-analysis of pro-environmental behaviour spillover. *Nature Sustainability*, 2(4), 307-315.
- Meijers, M. H., Verlegh, P. W., Noordewier, M. K., & Smit, E. G. (2015). The dark side of donating: how donating may license environmentally unfriendly behavior. *Social Influence*, 10(4), 250-263.
- Nilsson, J. (2009). Segmenting socially responsible mutual fund investors. *International Journal of Bank Marketing* 27 (1), 5–31.
- Nilsson, A., Bergquist, M., & Schultz, W. P. (2017). Spillover effects in environmental behaviors, across time and context: a review and research agenda. *Environmental Education Research*, 23(4), 573-589.
- Paetzold, F., & Busch, T. (2014). Unleashing the powerful few: Sustainable investing behaviour of wealthy private investors. *Organization & Environment*, 27(4), 347-367.
- Peterson, R. A., & Merunka, D. R. (2014). Convenience samples of college students and research reproducibility. *Journal of Business Research*, 67(5), 1035-1041.
- Raufeisen, X., Wulf, L., Köcher, S., Faupel, U., & Holzmüller, H. H. (2019). Spillover effects in marketing: integrating core research domains. *AMS Review*, 9(3-4), 249-267.
- Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32(9), 1723-1742.
- Renneboog, L., Ter Horst, J., & Zhang, C. (2012). Money-Flows of Socially Responsible Investment Funds around the World. *Socially Responsible Finance and Investing: Financial Institutions, Corporations, Investors, and Activists*, 455-477.
- Riedl, A., & Smeets, P. (2017). Why do investors hold socially responsible mutual funds?. *The Journal of Finance*, 72(6), 2505-2550.
- Rossi, M., Sansone, D., Van Soest, A., & Torricelli, C. (2019). Household preferences for socially responsible investments. *Journal of Banking & Finance*, 105, 107-120.
- Sachdeva, S., Iliev, R., & Medin, D. L. (2009). Sinning saints and saintly sinners: The paradox of moral self-regulation. *Psychological Science*, 20(4), 523-528.

- Sawyer, A. G., Worthing, P. M., & Sendak, P. E. (1979). The role of laboratory experiments to test marketing strategies. *Journal of Marketing*, 43(3), 60-67.
- Smith, G. (2004). Brand image transfer through sponsorship: A consumer learning perspective. *Journal of Marketing Management*, 20(3-4), 457-474.
- Statman, M. (2004). What do investors want?. *The Journal of Portfolio Management*, 30(5), 153-161.
- Thøgersen, J., & Crompton, T. (2009). Simple and painless? The limitations of spillover in environmental campaigning. *Journal of Consumer Policy*, 32(2), 141-163.
- Tiefenbeck, V., Staake, T., Roth, K., Sachs, O., 2013. For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign. *Energy Policy*, 57, 160–171
- Truelove, H.B., Carrico, A.R., Weber, E.U., Raimi, K.T. and Vandenbergh, M.P., 2014. Positive and negative spillover of pro-environmental behavior: An integrative review and theoretical framework. *Global Environmental Change*, 29, pp.127-138.
- Webley, P., Lewis, A., & Mackenzie, C. (2001). Commitment among ethical investors: An experimental approach. *Journal of Economic Psychology*, 22(1), 27-42.
- Wins, A., & Zwergel, B. (2016). Comparing those who do, might and will not invest in sustainable funds: A survey among German retail fund investors. *Business Research*, 9(1), 51-99.

APPENDIX

A.1. Brief overview of the experimental design in Study 1

Group 1 (treatment group)

The following information was presented in Norwegian to the participants in Group 1.

Page 1

Imagine that you have received NOK 500,000 in inheritance from a family member. You have decided to invest the money for long-term savings. With this scenario in mind, please answer the following questions based on how you would act in your real life. Your answers are completely anonymous.

Page 2 (Treatment)

In relation with the payment of the inheritance, you are informed that your family member had made it a requirement that you should donate 1% of the inheritance, i.e. NOK 5,000, to an NGO that works with environmental protection. The NGO works actively to combat climate change (e.g., tree planting and other climate measures) and is valued by the authorities and the media for its efforts. You are obliged to donate NOK 5,000 to the voluntary organization.

Page 3

You have four investment options, all mutual funds, to invest the money you have inherited. You are now prompted to rank them in order of priority. Below is a brief description of these funds that can help you in the assessment.

Mutual Fund A

Your first option is mutual fund A. Mutual fund A invests in several companies. In the previous year, compared with the total market, the fund gave a stable return. This means that the fund gave a steady return throughout the year.

Mutual Fund B

Your second option is mutual fund B. Mutual fund B invests in some environmentally friendly companies. In the previous year, compared with the total market, the fund gave a volatile return. This means that the fund sometimes gave higher and sometimes lower returns compared to the total market throughout the year.

Mutual Fund C

Your third option is mutual fund C. Mutual fund C invests in several environmentally friendly companies. In the previous year, compared with the total market, the fund gave a stable return. This means that the fund gave a steady return throughout the year.

Mutual Fund D

Your fourth option is mutual fund D. Mutual fund D invests in some companies. In the previous year, compared with the total market, the fund gave a volatile return. This means that the fund sometimes gave higher and sometimes lower returns compared to the total market throughout the year.

Please rank based on the funds you want to invest (ranking 1 means the highest priority and ranking 4 means the lowest priority):

- Mutual Fund A**
- Mutual Fund B**

- Mutual Fund C**
- Mutual Fund D**

The respondents were then presented with a questionnaire to measure demographic characteristics, behavioural attitudes and factors related to social norms.

Group 2 (control group)

The following information was presented in Norwegian to the participants in Group 1.

Page 1

Imagine that you have received NOK 500,000 in inheritance from a family member. You have decided to invest the money for long-term savings. With this scenario in mind, please answer the following questions based on how you would act in your real life. Your answers are completely anonymous.

Page 2

You have four investment options, all mutual funds, to invest the money you have inherited. You are now prompted to rank them in order of priority. Below is a brief description of these funds that can help you in the assessment.

Mutual Fund A

Your first option is mutual fund A. Mutual fund A invests in several companies. In the previous year, compared with the total market, the fund gave a stable return. This means that the fund gave a steady return throughout the year.

Mutual Fund B

Your second option is mutual fund B. Mutual fund B invests in some environmentally friendly companies. In the previous year, compared with the total market, the fund gave a volatile return. This means that the fund sometimes gave higher and sometimes lower returns compared to the total market throughout the year.

Mutual Fund C

Your third option is mutual fund C. Mutual fund C invests in several environmentally friendly companies. In the previous year, compared with the total market, the fund gave a stable return. This means that the fund gave a steady return throughout the year.

Mutual Fund D

Your fourth option is mutual fund D. Mutual fund D invests in some companies. In the previous year, compared with the total market, the fund gave a volatile return. This means that the fund sometimes gave higher and sometimes lower returns compared to the total market throughout the year.

Please rank based on the funds you want to invest (ranking 1 means the highest priority and ranking 4 means the lowest priority):

- Mutual Fund A**
- Mutual Fund B**
- Mutual Fund C**

□ **Mutual Fund D**

The respondents were then presented with a questionnaire to measure demographic characteristics, behavioural attitudes and factors related to social norms. The respondents were also provided with information on the donation, but only after they had made their investment decision.

A.2. Brief overview of the experimental design in Study 2

Group 1

Following information was presented to the participants in Group 1.

Page 1

You have been given 150 NOK to allocate your investments in two stocks. Your earnings from this scenario will depend on the performance of the stocks, which will be computer-simulated based on the individual stock history and overall market performance. Furthermore, we want to inform you that we will deduct 10 NOK from your earnings and it will be donated to a charity organization fighting against climate change. So, your final earnings from this scenario will be revenue from your stock performance minus 10 NOK.

Page 2

Below are your two stock options for your investment:

Stocks	Sector	Stock Price	Avg. yearly return	Market Cap.	Div. yield	52- week high	52- week low	Ethical Labelling*
Stock A	Energy	14.91	8.56%	\$49.06 B	5.84%	21.04	8.41	▲
Stock B	Energy	9.48	4.18%	\$49.43 B	5.80%	13.61	5.98	▲

*Ethical labelling represents the company's environmental performance. Green illustrates strong pro-environmental performance of the company whereas red suggest company has bad environmental performance.

*You can use the following formula to calculate the earnings from a stock:

$$\text{Earnings} = (\text{Amount invested in stock} * \text{Avg. Yearly Return}) + (\text{Amount invested in stock} * \text{Div. yield})$$

Page 3

Please allocate your investment of 150 NOK in two stocks (total must be 150 NOK)

- Stock A
- Stock B

Afterwards the respondents were presented with a questionnaire to measure demographic characteristics, behavioural attitudes and factors related to social norms.

Group 2

The following information was presented to the participants in Group 2.

Page 1

You have been given 150 NOK to allocate your investments in two stocks. Your earnings from this experiment will depend on the performance of the stocks, which will be computer-simulated based on the individual stock history and overall market performance. Furthermore, we want to inform you that at the end of the scenario you will have the option to donate a fixed amount (10 NOK) to a charity organization fighting against climate change. If you choose to donate, your final earnings from this scenario will be revenue from your stock performance minus 10 NOK.

Page 2

Below are your two stock options for your investment:

Stocks	Sector	Stock Price	Avg. yearly return	Market Cap.	Div. yield	52- week high	52- week low	Ethical Labelling*
Stock A	Energy	14.91	8.56%	\$49.06 B	5.84%	21.04	8.41	▲
Stock B	Energy	9.48	4.18%	\$49.43 B	5.80%	13.61	5.98	▲

*Ethical labelling represents the company's environmental performance. Green illustrates strong pro-environmental performance of the company whereas red suggest company has bad environmental performance.

*You can use the following formula to calculate the earnings from a stock:

Earnings = (Amount invested in stock * Avg. Yearly Return) + (Amount invested in stock * Div. yield)

Page 3

Please allocate your investment of 150 NOK in two stocks (total must be 150 NOK)

- Stock A
- Stock B

Afterwards the respondents were presented with a questionnaire to measure demographic characteristics, behavioural attitudes and factors related to social norms.

Group 3 (control group)

The following information was presented to the participants in Group 3.

Page 1

You have been given 150 NOK to allocate your investments in two stocks. Your final earnings from this experiment will depend on the performance of the stocks, which will be computer-simulated based on the individual stock history and overall market performance. You can allocate your investments in the two stocks as you see fit.

Page 2

Below are your two stock options for your investment:

Stocks	Sector	Stock Price	Avg. yearly return	Market Cap.	Div. yield	52- week high	52- week low	Ethical Labelling*
Stock A	Energy	14.91	8.56%	\$49.06 B	5.84%	21.04	8.41	▲
Stock B	Energy	9.48	4.18%	\$49.43 B	5.80%	13.61	5.98	▲

*Ethical labelling represents the company's environmental performance. Green illustrates strong pro-environmental performance of the company whereas red suggest company has bad environmental performance.

*You can use the following formula to calculate the earnings from a stock:

$$\text{Earnings} = (\text{Amount invested in stock} * \text{Avg. Yearly Return}) + (\text{Amount invested in stock} * \text{Div. yield})$$

Page 3

Please allocate your investment of 150 NOK in two stocks (total must be 150 NOK)

- Stock A
- Stock B

Afterwards the respondents were presented with a questionnaire to measure demographic characteristics, behavioural attitudes and factors related to social norms. They were also provided with information on the donation, but only after they had made their investment decision.

CHAPTER V

Concluding Remarks

Businesses require actionable insights from academic research in the transition toward becoming more sustainable. This transition involves the transformation of business models, effective communication with stakeholders (e.g., consumers), the encouragement of sustainable behaviour and advancement of sustainable finance. Based on experiments as the primary research methodology and the conceptual framework of business experimentation, the research presented in this dissertation addresses these challenges and offers insights useful for businesses in their journey toward becoming more sustainable.

To facilitate sustainable transitions for businesses, integration of sustainability through business model innovation is key (Schaltegger et al., 2012). The question in this regard is the following: How can a business successfully engage in a business model innovation process when the evidence suggests a high degree of uncertainty and failure (Geissdoerfer et al., 2018)? Scholars have argued that the path to successful business model innovation involves business model experimentation (BES) (McGrath, 2010; Evans et al., 2017). The aim of the first paper presented in this dissertation was to investigate a real-life BES process for green value propositions in the consumer goods market. It is important to note here that the value proposition is a central element of a business model. In fact, a real redesign of a business model only takes place when a business innovates the value proposition of its business model, thereby replacing the underlying business logic (Schaltegger et al., 2012).

The findings of the paper demonstrate the challenges companies face while navigating the process of business model innovation for sustainability and the role of BES in this process. BES is an extensive course of change that requires businesses to engage in continuous processes of trial and error, conduct qualitative and quantitative studies, develop prototypes, and perform A/B testing in order to derive actionable insights (Bocken et al., 2019). The paper shows the reiterative nature of BES in a real-life situation in which a large, well-established company undertakes multiple stages of analysis, experimentation and design in order to transform an existing business model into a new more sustainable business model. At a micro level, the

findings reveal consumer responsiveness to the sustainable innovations, and the drivers of and barriers to the adoption of those innovations. The barriers to the adoption of green solutions involve a trade-off between the convenience and perceived sustainability of product solutions in addition to factors documented in the extant literature, such as price, social norms, peer influence, product safety and privacy (e.g., Ottman et al., 2006; Seyfang, 2005; Welsch & Kühling, 2009; Barbarossa & De Pelsmacker, 2016). Another important factor highlighted in our findings is consumers' undervaluation of the benefits of sustainable product-service systems (S.PSS), and their overvaluation of their costs and risks (Vezzoli et al., 2015). Thus, the paper underscores the importance of communicating new sustainable value propositions to consumers and demonstrates how to overcome barriers to the adoption of sustainable products using message-framing techniques.

I further elaborate on the relevance of effective communication for stimulating sustainable consumption in the second article of my dissertation. Communication of a sustainable business model to consumers is an important aspect of pursuing a sustainable business (Viciunaite, 2020). As key enablers of sustainable consumption through the design of their products and services, businesses can capitalise on their sustainability efforts by presenting them in a way that is meaningful to consumers (Michaelis, 2003; Tunn et al., 2019; Viciunaite, 2020). A vast body of literature suggests that one way to increase consumers' support for sustainable products is through clear and efficient communication (e.g., Connell, 2010; Camilleri et al.; 2019; Darnall et al., 2018; Viciunaite, 2020). How can companies communicate the sustainable value of their products? The second article in this dissertation answers this key question.

Marketing innovations in the form of QR codes can be an efficient platform for communication of sustainability-related information from companies to consumers. However, the extant research on this platform is limited (Atkinson, 2013; Okazaki et al., 2019). The paper contributes to this gap in the literature by offering insights into the drivers and barriers of intentions to use QR codes as well as the actual use of the technology in a real-life retail setting. The findings reveal that behavioural factors from the technology acceptance model (i.e., perceived ease of use, perceived usefulness and attitude toward the technology) are significant predictors of intentions to scan QR codes. Scan intention is also enhanced by environmental cues, placement of the QR codes and message appeals. These results are in line with the previous literature (Ryu & Murdock, 2013; Pancer et al., 2017; Lim et al., 2020; Kronrod et al., 2012). A subsequent field experiment on consumers' actual scanning behaviour provided evidence on the use of the QR codes to access sustainability information as well as the positive

attitude of consumers toward the QR codes. The extant research lacks field evidence on the efficacy of QR codes, and this paper contributes to the literature in this regard (Okazaki et al., 2019). Overall, the paper shows the value of marketing innovations for bridging the information gap between companies and consumers with respect to sustainable products. The extant literature documents the lack of sustainability-related product information at the point of purchase as a potential structural barrier to sustainable consumption (Sachdeva et al., 2015; Shao, 2016). Using field experimentation as the research methodology, the paper demonstrates the value of leveraging the QR code technology to communicate sustainability-related product information to consumers that may encourage sustainable consumption (White et al., 2019).

The third and fourth articles presented in this dissertation underscore the importance of considering sustainable behaviour in a dynamic setting. While the findings of the third article provide only limited evidence of consistency effects between pro-environmental behaviours (PEBs) over time in everyday consumption decisions, the findings of the fourth article offer some evidence of spillover effects in individual investment behaviours related to sustainable investment choices. Thus, policy interventions intended to encourage PEBs should consider the spillover or spillover effects of different PEBs in order to achieve the overall desired positive effect (Tiefenbeck et al., 2013). Crucially, however, the ambiguity of the results in these two studies suggest that more research – and in particular field-experimental approaches – is needed in order to better capture such dynamic behaviours in consumer and investor decision-making.

It is important to mention here that while the transition to sustainable business models and sustainable consumption are important elements of sustainable business, access to financial capital is also critical. Indeed, the significance of access to capital in the capital markets for sustainability has been recognised at a macro level, as reflected in the EU's action plan for sustainable finance (European Commission, 2022). The extant literature argues that funding has been insufficient to meet environmental and societal challenges, and that unlocking private retail financing for a low-carbon economy is a critical enabler for the transformation toward sustainability (Ferraro & Pattanayak, 2006; James et al., 1999; Clark et al., 2018). Thus, the fourth article in this dissertation contributes to the literature by advancing our knowledge of retail investor behaviour in settings where retail investors are presented with sustainable investment choices.

The cross-sector collaboration between companies and researchers reflected throughout the studies in this dissertation highlights the potential for applying knowledge-based approaches in the design of sustainable business. Cross-sector collaboration between companies and

researchers can allow for the application of scientific methods in the pursuit of actionable, evidence-based insights for innovation purposes, regardless of whether the focus is on marketing or business model innovations (Pedersen et al., 2021). The uncertainty involved in a company's pursuit of sustainable innovation can be reduced by applying such approaches. Moreover, through multiple studies, I shed light on how collecting data from a combination of more and less controlled environments in both the lab and the field can provide richer insights relevant for knowledge advancement as well as managerial decision-making. I conducted my research on real product and marketing solutions that the company found commercially viable to pursue, which shows that scientific methods can be aligned with the commercial objectives of various businesses.

In light of the findings presented in this dissertation, several avenues for future research have emerged. Whilst each article in this dissertation discusses a more specific agenda for research pertaining to the findings of the respective article, there are at least three broad levels of research avenues that require further scientific inquiry. At a conceptual level, I study business experimentation for sustainability as it relates to business model innovations and marketing innovations and the value of such experimentation for the design of more sustainable solutions. Future research can investigate the role of business experimentation for sustainable transitions in other organisational areas such as business operations, supply chain and so on. At a methodological level, the dissertation primarily utilises online experiments, which generally offers more control to the researcher on the experimental settings. However, for a broader generalisation of results we need more field-based research that investigates such relationships in real life settings using field experiments. In fact, business experimentation, which has been a focus in this dissertation, can be referred to as a “plumbing problem” as it deals with design and implementation of sustainable strategies through trial and error, A/B testing, tinkering, and adjusting (Duflo, 2017). Such “plumbing problems” necessitate the use of field experiments to advance knowledge while answering questions with the mindset of what may work in the real world (Spicer et al., 2021). Finally, on the empirical side, the research in this dissertation shows that sustainable behaviours at the individual level need to be understood in a dynamic setting, where past behaviours can influence future behaviours and vice versa. Therefore, further knowledge advancement in the broader theme of corporate sustainability requires that we revisit existing studies that consider behaviours as one-time phenomenon and further investigate such relationships in a more dynamic setting.

REFERENCES

- Atkinson, L. (2013). Smart shoppers? Using QR codes and 'green' smartphone apps to mobilize sustainable consumption in the retail environment. *International Journal of Consumer Studies*, 37(4), 387-393.
- Barbarossa, C., & De Pelsmacker, P. (2016). Positive and negative antecedents of purchasing eco-friendly products: A comparison between green and non-green consumers. *Journal of Business Ethics*, 134(2), 229-247.
- Bocken, N., Boons, F., & Baldassarre, B. (2019). Sustainable business model experimentation by understanding ecologies of business models. *Journal of Cleaner Production*, 208, 1498-1512.
- Camilleri, A. R., Larrick, R. P., Hossain, S., & Patino-Echeverri, D. (2019). Consumers underestimate the emissions associated with food but are aided by labels. *Nature Climate Change*, 9(1), 53-58.
- Clark, R., Reed, J., & Sunderland, T. (2018). Bridging funding gaps for climate and sustainable development: Pitfalls, progress and potential of private finance. *Land Use Policy*, 71, 335-346.
- Connell, K. Y. H. (2010). Internal and external barriers to eco-conscious apparel acquisition. *International Journal of Consumer Studies*, 34(3), 279-286.
- Darnall, N., Ji, H., & Vázquez-Brust, D. A. (2018). Third-party certification, sponsorship, and consumers' ecolabel use. *Journal of Business Ethics*, 150(4), 953-969.
- Duflo, E. (2017). The economist as plumber. *American Economic Review*, 107(5), 1-26.
- European Commission. (2022, January 6). Renewed Sustainable Finance Strategy and implementation of the action plan on financing sustainable growth. European Commission. Retrieved June 1, 2022, from https://ec.europa.eu/info/publications/sustainable-finance-renewed-strategy_en.
- Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., & Barlow, C. Y. (2017). Business model innovation for sustainability: Towards a unified perspective for creation of sustainable business models. *Business Strategy and the Environment*, 26(5), 597-608.

- Ferraro, P. J., & Pattanayak, S. K. (2006). Money for nothing? A call for empirical evaluation of biodiversity conservation investments. *PLoS Biology*, 4(4), e105.
- Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018). Sustainable business model innovation: A review. *Journal of Cleaner Production*, 198, 401-416.
- ISO 26000. (2011). *Guidance on social responsibility*. Geneva, Switzerland.
- James, A. N., Gaston, K. J., & Balmford, A. (1999). Balancing the Earth's accounts. *Nature*, 401(6751), 323-324.
- Kronrod, A., Grinstein, A., & Wathieu, L. (2012). Go green! Should environmental messages be so assertive?. *Journal of Marketing*, 76(1), 95-102.
- Lim, D., Baek, T. H., Yoon, S., & Kim, Y. (2020). Colour effects in green advertising. *International Journal of Consumer Studies*, 44(6), 552-562.
- McGrath, R. G. (2010). Business models: A discovery driven approach. *Long Range Planning*, 43(2-3), 247-261.
- Michaelis, L. (2003). The role of business in sustainable consumption. *Journal of Cleaner Production*, 11(8), 915-921.
- Okazaki, S., Navarro, A., Mukherji, P., & Plangger, K. (2019). The curious versus the overwhelmed: Factors influencing QR codes scan intention. *Journal of Business Research*, 99, 498-506.
- Ottman, J. A., Stafford, E. R., & Hartman, C. L. (2006). Avoiding green marketing myopia: Ways to improve consumer appeal for environmentally preferable products. *Environment: Science and Policy for Sustainable Development*, 48(5), 22-36.
- Pancer, E., McShane, L., & Noseworthy, T. J. (2017). Isolated environmental cues and product efficacy penalties: The color green and eco-labels. *Journal of Business Ethics*, 143(1), 159-177.
- Pedersen, E. R. G., Lüdeke-Freund, F., Henriques, I., & Seitanidi, M. M. (2021). Toward collaborative cross-sector business models for sustainability. *Business & Society*, 60(5), 1039-1058.
- Ryu, J.S., & Murdock, K. (2013). Consumer acceptance of mobile marketing communications using the QR code. *Journal of Direct, Data and Digital Marketing Practice*, 15(2), 111-124.

- Sachdeva, S., Jordan, J., & Mazar, N. (2015). Green consumerism: moral motivations to a sustainable future. *Current Opinion in Psychology*, 6, 60-65.
- Schaltegger, S., Lüdeke-Freund, F., & Hansen, E. G. (2012). Business cases for sustainability: the role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, 6(2), 95-119.
- Seyfang, G. (2005). Shopping for sustainability: can sustainable consumption promote ecological citizenship?. *Environmental Politics*, 14(2), 290-306.
- Shao, J. (2016). Are present sustainability assessment approaches capable of promoting sustainable consumption? A cross-section review on information transferring approaches. *Sustainable Production and Consumption*, 7, 79-93.
- Spicer, A., Wagner, M., & Zollo, M. (2021). Tinkering with the plumbing of sustainable enterprises: the case for field experimental research in corporate sustainability. *Organization & Environment*, 34(3), 351-360.
- Tiefenbeck, V., Staake, T., Roth, K., & Sachs, O. (2013). For better or for worse? Empirical evidence of moral licensing in a behavioral energy conservation campaign. *Energy Policy*, 57, 160-171.
- Tunn, V. S. C., Bocken, N. M. P., van den Hende, E. A., & Schoormans, J. P. L. (2019). Business models for sustainable consumption in the circular economy: An expert study. *Journal of Cleaner Production*, 212, 324-333.
- Vezzoli, C., Ceschin, F., Diehl, J. C., & Kohtala, C. (2015). New design challenges to widely implement 'Sustainable Product-Service Systems'. *Journal of Cleaner Production*, 97, 1-12.
- Viciunaite, V. (2020). Communicating sustainable business models to consumers: A translation theory perspective. *Organization & Environment*, 1086026620953448.
- Welsch, H., & Kühling, J. (2009). Determinants of pro-environmental consumption: The role of reference groups and routine behavior. *Ecological Economics*, 69(1), 166-176.
- White, K., Habib, R., & Hardisty, D. J. (2019). How to SHIFT consumer behaviors to be more sustainable: A literature review and guiding framework. *Journal of Marketing*, 83(3), 22-49.