Stimulating food waste reduction behaviour among hotel guests through context manipulation

Hannes Antonschmidt [a,*], Dagmar Lund-Durlacher [b]

[a] *SRH Berlin University of Applied Sciences, Dresden School of Management, Dresden, Germany*
[b] *Department of Tourism and Service Management, Modul University Vienna, Vienna, Austria*

ARTICLE INFO

ABSTRACT

Food waste is a significant problem in the holiday hotel industry. However, although sustainability theorists argue for consumer-oriented behavioural interventions, there is a lack of empirical studies that could clearly demonstrate the effectiveness of such interventions. This study addresses this research gap and uses an experimental design to be able to identify cause-and-effect-relationships between an intervention promoting food waste reduction and real guest behaviour. The study context is an all-you-can-eat buffet restaurant in a typical sun-and-beach holiday hotel.

The experimental results demonstrate a direct effect of the context manipulation, as reflected in a significant 14.4% reduction in edible plate waste. In contrast, attitudes remained constant highlighting that their change is not a necessary condition for behaviour change. Furthermore, significant differences in attention to the tools were found between the three contact points 'entrance to the restaurant', 'buffet', and 'guest table' with 'guest table' being by far the strongest contact point. In summary, it can be said that consumers can be encouraged to act responsibly even in hedonic, unrestricted consumption contexts if the communication tools are placed effectively. Hotels thus have the opportunity to involve their guests in environmental protection measures.

1. Introduction

Within the EU-28, around 88 million tonnes of food waste are disposed of across the supply chain each year. Food waste from the food service industry has been identified as one of the main contributors with 11 million tonnes (Stenmarck et al., 2016).

Depending on the type of business and hygiene standards, around 20–60% of all food purchased by holiday hotels ends up in the trash (Lund-Durlacher et al., 2016). Almost 80% of this amount of waste can be avoided either by producers or consumers (Filimonau and De Coteau, 2019). This situation not only reflects poor cost management by hotels and food service businesses (Filimonau and De Coteau, 2019; Okumus, 2019), but is also highly concerning from an ethical perspective, considering that there are nearly one billion undernourished people in the world (FAO, IFAD, UNICEF, WFP, WHO, 2019). In addition, food waste leads to unnecessary consumption of natural resources such as land and water and generates unnecessary emissions of CO_2 (from transport and food production processes), methane gas (from livestock farming and landfills) and nitrous oxide (from fertiliser use), which contribute significantly to climate change (Gössling and Peeters, 2015;

Intergovernmental Panel on Climate Change IPCC, 2019; Juvan et al., 2018; Lund-Durlacher et al., 2016). Scherhaufer, Moates, Hartikainen, Waldron, and Obersteiner (2018) show that 186 Mt of CO_2-equivalent emissions are attributable to food waste in Europe alone. Reducing food waste could reduce these negative environmental impacts.

In the quest for strategies for reducing food waste, sustainability theorists argue for a stronger role of the consumer (Ehgartner, 2018). However, the empirical basis for the effectiveness of consumer-oriented behavioural interventions is scanty. In particular, there is a lack of experimental designs that could clearly demonstrate the effectiveness of such interventions. This study addresses this research gap and uses an experimental design to be able to identify cause-and-effect-relationships between an intervention promoting food waste reduction and real guest behaviour.

The study's two specific objectives are:

(1) To test the impact of communication tools on hotel guests' food waste attitudes and behaviours. This will examine how consumers respond to food waste information in a hedonic travel

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context and whether they change their food waste attitudes and behaviours.

(2) Based on the assumption that not all contact points of the communication tools are equally effective, the second objective of the study is to find out which contact points are most suitable for influencing behaviours.

The corresponding research questions are:

RQ 1: Can the use of point-of-consumption communication tools that promote 'waste prevention' to sun-and-beach holiday hotel guests reduce the amount of edible plate waste?

RQ 2: Which contact point to promote 'waste prevention' achieves the highest attention values by sun-and-beach holiday hotel guests?

The paper contributes to the academic discourse on consumer responsibility and engagement in environmental protection. Based on Stern's Attitude-Behaviour-Context (ABC) theory, the study examines his assumption that consumer behaviour (B) is an "interactive product of personal sphere attitudinal variables (A) and contextual factors (C)" (Stern, 2000, p. 415) and may change if A or C are varied. In our study, attitudinal variables include personal beliefs, norms, values, and 'predispositions' to act in an environmentally conscious way, especially in relation to food consumption during holidays. Contextual factors include food waste information signs ('communication tools') placed at various locations in the hotel restaurant.

The paper is structured as follows: A literature review first introduces the problem of food waste in food services and outlines strategies to influence consumer behaviour with regard to food waste. Subsequently, research hypotheses are derived based on the literature. The quasi-experimental approach used to test the hypotheses is described in detail in the following section, along with a description of how the experiments were conducted in the test hotel. The results are then presented before conclusions are drawn and a discussion contextualises the findings.

2. Literature review

In order to address the issue of food waste in holiday hotels, it is necessary to describe the context of holiday hotels, outline the specific problem of food waste in holiday hotels and review those factors that influence the extent of food waste. In addition, previous studies on food waste prevention can serve as a first reference point for the development of appropriate communication tools.

2.1. The holiday hotel context

Addressing the holiday hotel context is important because the purchase situation there differs from regular purchase situations in several ways. Holiday hotels can be seen as a hedonistic context where the focus is on individual enjoyment and maximising individual benefits at minimal individual costs (Dolnicar et al., 2017). Accordingly, the moral obligation to behave in an environmentally conscious way is lowest in this type of accommodation (Dolnicar and Grün, 2009). Providers respond to this hedonistic motive by offering unrestricted consumption options in their hotels, especially with regard to food (Koc, 2013). It is therefore likely that a mutually reinforcing effect of individual behaviour and context prevails (Burke et al., 2009).

Depending on the type of hotel, food can be classified as one of the most important enjoyment components of a trip (McKercher, 2016). Therefore, hotels often face a dilemma between customer satisfaction and restrictive waste prevention measures (Okumus et al., 2020). In all-you-can-eat situations, guests can consume as much food as they want after paying a lump-sum for the entire travel package in advance. Guests are therefore not constrained in their consumption by short-term direct costs. Tavares and Kozak (2015) find that food is considered the most important item when purchasing such all-inclusive packages. However, the unrestricted consumption options often lead to tendencies

of unsustainable overconsumption (Farmaki et al., 2017; Woosnam and Erul, 2016).

Dolnicar et al. (2017), who did not achieve the expected behavioural effect with their experimental manipulation in a Slovenian holiday hotel, conclude (p. 8) that the "effectiveness of pro-environmental appeals in triggering pro-environmental behaviour is context dependent" and that "pro-environmental appeals are ineffective in hedonic [holiday hotel] contexts". However, in a recent study in two Slovenian sun-and-beach holiday hotels, Dolnicar et al. (2020) achieve a 34% reduction in edible plate waste through a game-based intervention. Results from other studies (e.g. Bohner and Schlüter, 2014; Goldstein et al., 2008) also show that communication tools can be effective in certain hedonistic holiday hotel contexts.

2.2. Consumer attitudes and behaviour with respect to food

An online survey (n = 7915) on the topic of sustainable food on holiday shows that there are positive attitudes towards sustainable food among package tourists (Lund-Durlacher et al., 2016). López-Sánchez and Pulido-Fernández (2016) find that for most tourists, attitudes, values, and behaviours towards sustainability are consistent. This positive linear relationship between attitudes or values and sustainable consumption is confirmed by several empirical studies (do Paço et al., 2018; Jacobs et al., 2018; Landon et al., 2018; Paul et al., 2016; Shin et al., 2017).

Similarly, however, several studies in the tourism context report an attitude-behaviour gap where tourists report pro-sustainable attitudes but do not behave sustainably in reality (Juvan & Dolnicar, 2014, 2016). Miao and Wei (2013) provide a possible explanation for this phenomenon: they show that the influence of pro-environmental attitudes on environmental behaviour is lower in a hotel environment than in a home environment. Still, as Guagnano et al. (1995) argue, some influence of attitudes can be expected in most contexts.

2.3. Food waste in hotels

The problem of food waste in out-of-home consumption was already recognised as an ethical and economic problem in the years of shortage after the Second World War. An early empirical study by Youngs et al. (1983) also revealed the extent of the problem in the hospitality industry. It is now estimated that food waste costs the hospitality industry more than 2% of its annual revenue (Filimonau and De Coteau, 2019).

According to an analysis by United Against Waste (2016), food waste in the hotel industry is mainly generated during food preparation (32%), presentation at buffets (20%), and on guests' plates (20%). In contrast, only 11% is due to overproduction and 2% to storage, while 15% of the waste cannot be assigned to any specific process stage. In addition to waste reduction measures in food storage, production, and presentation by the hotel management and staff, guests also have a key role to play in minimising edible plate waste (Filimonau and De Coteau, 2019; Kallbekken and Saelen, 2013; Okumus, 2019). Edible plate waste is food that is served or plated but not eaten even though it is fit for consumption. Non-edible plate waste includes, for example, the peels, bones, or shells that are part of a dish, but cannot be eaten (Kuo and Shih, 2016).

Juvan et al. (2018) and Pirani and Arafat (2016) note that the amount of food waste depends on a number of factors, such as the nationality of guests, the proportion of children, the presence of guests in the breakfast area, the number of buffet stations, serving style and timing, menu design, type of food and planning accuracy. While the hotel can influence some of these parameters through appropriate staff training and professional menu and buffet planning (Filimonau and De Coteau, 2019; Okumus et al., 2020), another major cause for food waste is oversized ordering and oversized serving by guests: behaviours rooted in a lack of consumer awareness (Okumus, 2019; Okumus et al., 2020; Pirani and Arafat, 2016). As mitigation measures, these studies recommend greater consumer engagement through targeted consumer

information and education on food waste (Filimonau and De Coteau, 2019; Okumus, 2019; Youngs et al., 1983).

2.4. Conceptualisations of guest behaviour with respect to food waste

A review of conceptualisations of guest behaviour with respect to food waste highlights the importance of three key elements: consumer attitudes towards food waste prevention, social norms (perceptions of what type of behaviour is acceptable in a certain social context or the actual behaviour of other people), and behavioural control (the ability to perform a behaviour). In addition, guests need to be put in a state of awareness or concern for the issue of food waste so that they can act accordingly (Joshi and Rahman, 2017; Kumar et al., 2017; Stancu et al., 2016; Vermeir and Verbeke, 2006).

The primary goal of a communication tool is to create this awareness on the part of the consumers. Afterwards, norms can be communicated and behavioural control can be reassured (Okumus et al., 2020). Also, attitudes can materialize in a state of awareness. This is important because successful interventions usually rely on positive attitudes towards the desired behaviour as a necessary condition for behavioural change (Coşkun and Yetkin Özbuk, 2020).

In addition, various parameters such as socio-demographic variables of the guests should be taken into account. These can also represent cultural differences which are known to influence food waste behaviour (Okumus et al., 2020). Other parameters include food-related variables such as the type of restaurant or the purpose of the meal (Dhir et al., 2020).

The aforementioned studies were often based on different variants of the Theory of Planned Behaviour (TPB). However, a major shortcoming of this theory is its relative neglect of limiting contextual influences (Guagnano et al., 1995). In order to avoid a misinterpretation of the results due to an underestimation of the context effect, the present study builds on the Attitude-Behaviour-Context (ABC) theory, as it takes a comprehensive approach in considering contextual variables.

2.5. Interventions to reduce food waste

In order to persuade consumers to deviate from their usual behaviour, well thought-out communication techniques are needed. Hotels often use so-called nudging techniques to influence guests' food consumption and reduce edible plate waste (Kuo and Shih, 2016). Thaler and Sunstein (2008, p. 6) define a nudge as "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not." Typical nudging techniques to avoid food waste in hotels include offering smaller portions or single servings, using smaller serving bowls and plates, and live-cooking stations (Lund-Durlacher et al., 2016). Another popular nudging strategy is providing sustainability information to hotel guests (Lee and Oh, 2014). Stöckli et al. (2018a) argue that such informative interventions should be combined with prompts to increase their effectiveness.

While green marketing communication already addresses the issue of food waste in various contexts, empirical research regarding the impact of this communication on consumer behaviour in the context of sun and beach tourism is still scarce (Filimonau and De Coteau, 2019).

Table 1 provides an overview of previous experimental studies aimed at influencing consumer behaviour in relation to food and food waste. Overall, the results confirm the effectiveness of information strategies aiming to reduce environmental impacts through consumer behaviour. However, while these examples give an indication of the potential of food-related interventions and show possibilities for their technical implementation, only the study by Dolnicar et al. (2020) relates to the holiday hotel industry. Our study therefore aims to provide additional empirical evidence for this particular context.

3. Hypotheses development

The conclusion of Dolnicar et al. (2017) and the observed difference in home and holiday behaviour (Dolnicar and Grün, 2009; Gössling, 2015) suggest that context factors have a significant impact on guest behaviour. Indeed, underestimation of the role of context is considered a major reason for the ineffectiveness of many experimental interventions (Burke et al., 2009). An important theory that emphasises the role of context is the Attitude-Behaviour-Context (ABC) theory (Guagnano et al., 1995). The ABC theory states that the interplay of attitudinal and contextual variables, personal capabilities, and habits or routines determines individual behaviour. While the role of contextual variables is also central in other theories, e.g., Triandis' Theory of Interpersonal Behaviour (Triandis, 1977), ABC theory was chosen as the theoretical basis for this study because it takes contextual factors comprehensively

Table 1
Studies on food waste prevention.

Author	Country	Context	Intervention	Result
Chen and Jai (2018)	USA	Online experiment	• environmental focused message ("Reduce Waste for a Sustainable Future") • environmental focused and credibility message (logo of environmental protection agency) • threat-focused message ("We Charge \$5/per pound for Food Waste") • threat-focused and credibility message (logo of environmental protection agency)	• positive effect on attitudes towards the message and perceived CSR, indirect effect on behavioural intention (all for environmental and threat-focused message)
Dolnicar et al. (2020)	Slovenia	Sun-and-beach hotel restaurants	• flyer with/without environmental appeal • stamp collection booklet (game-based intervention) with/without environmental appeal	• reduced plate waste per family member for each of the conditions • no significant difference between the conditions
Kallbekken and Saelen (2013)	Scandinavia	Hotel restaurants	• communication tools promoting 'correct', i.e., waste-preventing, self-service behaviour ("Welcome back! Again! And again! Visit our buffet many times. That's better than taking a lot once.")	• reduction of food waste
Stöckli et al. (2018a)	Switzerland	Pizza restaurant	• informational ("One third of food is wasted. […]") • normative and informational prompts ("Our guests expect a reduction in food waste. One third of food is wasted. […]")	• increase in share of diners who are willing to take away leftovers
Whitehair et al. (2013)	USA	University dining facility	• instructive message ("All Taste … NO WASTE. EAT WHAT YOU TAKE. DON'T WASTE FOOD.") • instructive and feedback-based message ("On average, each resident wastes 2.15 oz of food each meal. This amounts to more than 32 pounds per person per semester. […] All Taste … NO WASTE.")	• reduction in food waste as a result of using the informational message • adding the feedback-based message did not lead to any additional significant reduction

into account and specifically aims to explain changes towards environmentally conscious behaviour (Guagnano et al., 1995). These characteristics fit both the experimental design and the study objective.

Context includes all influences outside the individual mind that might support or inhibit behaviour, such as economic costs and benefits, incentives, other people's behaviour, and cultural expectations (Guagnano et al., 1995). In the present study, the context is the environment of the test hotel. The test hotel was a typical four-star sun and beach holiday hotel in Maspalomas on the island of Gran Canaria (Spain). The hotel offers 229 rooms and accommodates up to 450 guests. Its restaurant has a capacity of 190 seats and offers all-you-can-eat buffets for all board types. The guest mix is exclusively adult and consists of young couples, small groups, families with older children, and pensioners. The guests mainly come from Germany, United Kingdom, Scandinavia and the Netherlands and visit for typical sun and beach holidays all year round.

The hotel's environmental balance is affected by the self-service buffet setting and the all-inclusive offer, where food is offered in large quantities and consumption is not limited. However, some factors mitigate the environmental burden. First of all, not every guest had an all-inclusive board arrangement. In addition, the price level of the hotel was relatively high (around $150 per person per night) compared to other all-inclusive offers, and no children under 16 were allowed in the hotel. These measures excluded price-sensitive guest groups and young families, who are known to be less environmentally conscious (Juvan et al., 2018).

Attitudes are the positive or negative intrinsic positions an individual holds towards a given behaviour. Stern (2005) argues that attitudes are a relatively weak predictor of behaviour compared to contextual variables. In the tourism context, this is reflected in the attitude-behaviour gap (Juvan and Dolnicar, 2014). Nevertheless, extreme attitudes towards a behaviour can inhibit the effectiveness of context manipulations to change behaviour (Guagnano et al., 1995). For the holiday hotel context, a survey by Lund-Durlacher et al. (2016) shows that tourists have moderately positive attitudes towards more sustainable food choices and are willing to contribute to reducing food waste.

Personal capabilities refer to the knowledge, skills, and available resources, such as time and money required to perform the behaviour. Socio-demographic variables (e.g., education, income, or age) can serve as proxies for these personal capabilities. Finally, habits and routines are regular, standardised behaviours that individuals have repeated many times and often perform unconsciously (Stern, 2000).

According to Guagnano et al. (1995, p. 702f.), "the success of any strategy designed to either induce or curtail behaviour will depend on the magnitude of the absolute value of the sum of A [attitudes] and C [context] [...]. When this absolute value is small, shifts in either A or C may act to move a particular combination of A and C across the diagonal line, thus resulting in behaviour change." This means that attitudes and context need to have an equally strong influence to allow behaviour change. Moreover, their effects should be contrarian. These conditions are taken as given for the tourists' attitudes and the context of the test hotel (Fig. 1).

Accordingly, the following hypothesis was formulated:

H1. Context manipulation using specific graphic and written communication tools will result in a reduction in the amount of edible plate waste.

Considering the mixed findings on the effectiveness of appeals in hedonistic holiday hotel contexts (Bohner and Schlüter, 2014; Dolnicar et al., 2017, 2020; Goldstein et al., 2008), we argue that the effectiveness of communication tools might depend on their positioning as guests are more receptive to visual and informational cues at certain contact points than at others (Dolnicar, 2020). In holiday hotels, there are already some typical contact points for guest information such as the lobby or the entrance to the restaurant. Therefore, the following hypothesis is formulated in relation to the second research question:
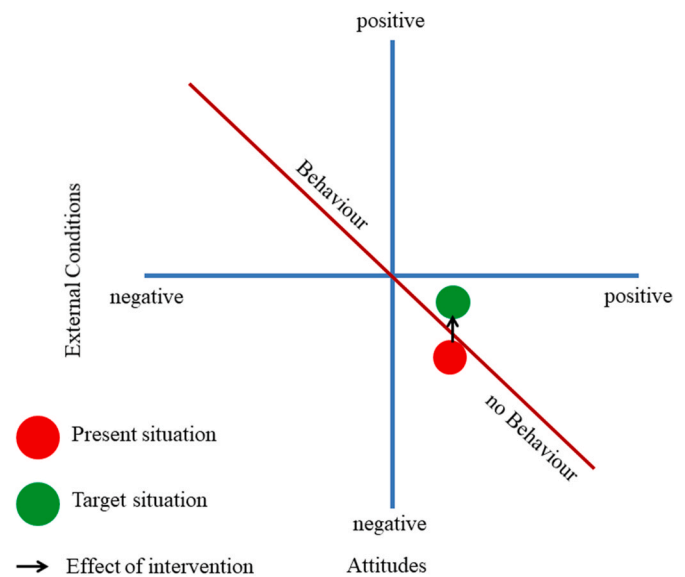
Source: own illustration according to Stern et al. (1995)

Fig. 1. A-B-C Model.

H2. The guests' attention to the communication tools varies across the different contact points in the hotel.

4. Methodology

The main objective of this study is to identify a causal relationship between the use of different types of environmental communication tools containing graphic and written messages and guest behaviour. The use of the communication tools is understood as the context manipulation based on moderately positive attitudes towards environmentally conscious behaviour of hotel guests. An experimental design in a real-life setting was chosen as the research method. Experimental designs allow cause-effect relationships to be unambiguously identified because confounding factors can be controlled for in the experimental setting (Shadish et al., 2002; Viglia and Dolnicar, 2020). Moreover, they use actual behaviour as the dependent variable, as opposed to, e.g., survey designs that use virtual, non-consequential choices as proxies for real-world behaviour. Experimental designs are therefore less prone to social desirability bias and have high instrumental validity (Shadish et al., 2002; Viglia and Dolnicar, 2020).

The main rationale for choosing an experimental design was to increase the validity of the study. Many studies investigating consumer behaviour suffer from low validity because they do not sufficiently take into account the discrepancy between reported and actual behaviour, the so-called attitude-behaviour gap (Viglia and Dolnicar, 2020). This gap is particularly pronounced because many tourists have pro-environmental attitudes which they do not exercise in the tourism context (Juvan and Dolnicar, 2014).

In classical experimental designs, the sample is randomly divided into two groups, assuming that all confounding factors are equally distributed between these two groups so that they influence the experimental results equally. As a rule, only one factor is manipulated in the treatment group, while the control group remains unmanipulated. This allows cause-effect relationships to be unambiguously identified (Viglia and Dolnicar, 2020). In this study, however, a strict experimental design was not feasible due to restrictions imposed by the hotel management, which did not allow random assignment of guests to test and control groups. In order to still benefit from the advantages of an experimental design without random group assignment, a quasi-experimental design was chosen instead (Shadish et al., 2002). In this approach, groups are

not randomly assigned, but an attempt is made to select existing groups that are as homogeneous as possible with respect to potentially confounding variables.

The experimental approach chosen was a 'post-test-only design' with non-equivalent groups (Shadish et al., 2002). This type of design measures the variable in question only once for each experimental condition, with the results later compared between groups. For this study, data collection was divided into a seven-day baseline (control) phase and a seven-day test (treatment) phase, with a seven-day break separating the two data collection phases. To compensate for non-random assignment to the experimental groups, the data collection period and hotel were chosen to ensure homogeneity between the data collection phases in terms of various socio-demographic and other characteristics of the guest clientele (age, country of origin, education, gender, size of the travel party, and type of board) (Viglia and Dolnicar, 2020). This approach achieved useable results in Dolnicar et al.'s (2020) study.

While context and behaviour are directly observable within an experimental design, attitude as the third major variable of the ABC theory is not directly observable. Furthermore, although confounding variables arising from the context — such as guest presence in the breakfast area, number of buffet stations, and type of food — could be visually captured and controlled for, other potential confounders such as certain socio-demographic variables could not be visually assessed. In addition, average food consumption as a determinant of food waste could not be measured directly because the hotel did not operate a respective control system. Therefore, a guest survey was conducted to collect attitudes and the control variables and complement the experimental design. Furthermore, attention values of the guests to the communication tools used at the various contact points were surveyed to answer RQ 2. The guest surveys were conducted after both baseline and control phases.

4.1. Conducting the study

The process of the study can be structured along four consecutive phases. The first two phases were focused on developing and testing the communication tools. After developing the prototypes in a co-design process with staff and guests in a hotel in Tyrol, Austria, the tools were evaluated after being used in this test hotel (phase 1). Then, the most promising tools were selected and adapted based on staff and guest feedback (phase 2). This preparatory work was to ensure the immediate applicability of the tools given the limited time frame and high resource requirements of the experiment. This was followed by the field phase in Gran Canaria during which the edible plate waste of the guests was collected, and the surveys were conducted. The data analysis with regard to the research questions and hypotheses took place in the last phase. The entire study had a duration of about 12 months.

4.1.1. Phase 1: development of the communication tools

The communication tools were developed through a co-design process that used the operational experience of hotel management and staff. In special workshops, the staff discussed the communicability of different aspects of sustainable food together with the researchers and developed initial ideas for communication tools and messages. The results of the workshops, as well as the results of a literature review, were then used by an information designer to further shape the tools.

The messages of the tools can be divided into three parts. The first part outlines what measures the hotel uses to avoid food waste. The intention is to impose a behavioural norm (Stancu et al., 2016; Vermeir and Verbeke, 2006; Whitehair et al., 2013). The text reads:

"UNITED AGAINST WASTE
We handle food carefully so that less is wasted.
- We plan our buffets conscientiously.
- Our dishes are freshly prepared, many are cooked in front of the guests.

- We offer a wide variety of different portion sizes.
- We would appreciate your feedback on our food."

The second part suggests some measures the guests can implement to avoid food waste. These actions address specific drivers of plate waste as outlined in Dolnicar and Juvan (2019). The aim is to emphasise consumer agency and market influence (Joshi and Rahman, 2017; Kumar et al., 2017). The text reads:

"WHAT CAN I DO?
- Start with smaller portions – have less on the plate but go to the buffet more often.
- Inform yourself about the dishes' ingredients before you make your choice.
- Let your children try from your plate to help them find their favourites."
Finally, factual information on the amount of food wasted is provided (Stöckli et al., 2018b; Vermeir and Verbeke, 2006). The text reads:

"1/3 OF THE FOOD ON EACH PLATE IS WASTED – WE CAN PREVENT 50% OF THIS!"

The communication messages were concrete and action-oriented and had a positive tone. The focus was on mitigating negative impacts.

4.1.2. Phase 2: pretesting of the tools & manipulation check

The different communication tools and their messages were pretested in a three-star holiday hotel in Austria; the hotel selection was based on the criterion of practicability. Guest feedback was collected via a structured survey (n = 12) as well as personal interviews and observations to support further adaptation of the tools. Eight different tools were tested, including four stand displays, small plate labels, buffet messages, food pickers, and place mats. The tools were placed at three different contact points: at the entrance to the restaurant, at the buffet, and on the guest tables. One conclusion from the guest feedback was that the tools placed on the tables and at the buffet achieved the highest attention. However, the results for the stand-up display at the entrance cannot be considered representative as the restaurant had more than one entrance. Therefore, not all guests passed by this contact point on their way to their tables. In addition, the place for the stand-up display was only dimly lit.

After the pre-test, an information designer developed the final set of communication tools. The tools have a standard layout, which was a requirement for the design. Logo and hotel specific information can be adapted to make them transferable to different hotel environments. Furthermore, the messages were provided in three languages (English, German, Spanish) to ensure that the majority of the guests in the test hotel could understand them.

To verify that the tools conveyed the intended message, a manipulation check was conducted with 25 undergraduate university students. Participants were shown each tool and then asked a multiple-choice question about each tool to what message they thought the tool conveyed. The results show that the participants' perceptions of the messages were consistent with the intended messages. Specifically, the results confirm that the tools impose a behavioural norm and emphasise individual agency in support of sustainability efforts (Fig. 2).

4.1.3. Phase 3: data collection in the test hotel

Data collection took place during the hotel's breakfast hours with the baseline phase starting on July 9, 2017 and the test phase starting on July 23, 2017. Each phase lasted seven days and the phases were separated by a seven-day break. In the baseline phase, no communication tools were used, but the total amount of edible plate waste was collected. A break in data collection was then taken to allow for rotation of guests to ensure independence of observations. In the subsequent test
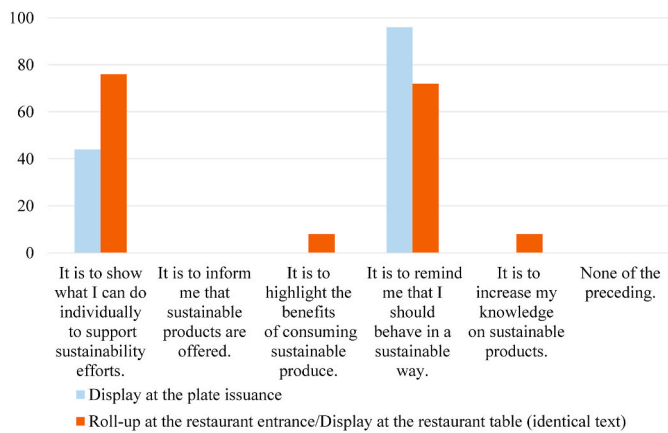
Fig. 2. Manipulation check results.

phase, the communication tools were positioned at the three contact points and the edible plate waste was collected again. In both phases, the context covariates (guest presence in the breakfast area, number of buffet stations, and type of food) were counted or visually inspected.

Furthermore, guest surveys conducted at the end of both baseline and test phase collected data regarding attitudes towards food sustainability issues, and socio-demographic and other guest data. The survey after the test phase additionally asked for the guests' attention towards the communication tools.

Breakfast was selected for the experiment over other meals because its contents do not vary much from day to day. In the test hotel, all guests took their breakfast in an all-you-can-eat buffet style restaurant within the hotel complex. There was no restriction on the type and amount of food that could be consumed for any board types during the breakfast period from 7:30 to 10:30am. The service stations were easily accessible so that no waiting lines or crowds occurred even at peak times. On average, 396 guests frequented the restaurant in the baseline and 393 guests in the test phase. The guests collected their plates when entering the buffet service area and then walked around the serving stations. The food selection included hot and cold international dishes such as scrambled eggs, cheese and sausage platters, fruits, and cereals.

4.1.3.1. Preparation. Before the data collection phase, a briefing was held with the hotel staff on how to correctly collect the edible plate waste (i.e., how to separate edible from non-edible plate waste, and how to collect the edible plate waste in special containers). Furthermore, the correct positioning of the communication tools was explained.

In line with the results of the pre-test, the communication tools were installed at the buffet and on the guest tables. Additionally, one communication tool was placed at the entrance to the restaurant as this contact point is already frequently used by restaurants to communicate, e.g., special offers. Therefore, it was assumed that hotel guests are

receptive to food-related information at this particular contact point. Each contact point was furnished with one communication tool. Fig. 3 provides an overview of the experimental layout.

4.1.3.2. Plate waste collection. The edible plate waste (food that was taken onto the plate but not eaten, excluding, e.g., peels, bones, or shells; not including liquid foods) was collected by waiters with cleaning carts during the breakfast period. Either the guests handed the waiter their plate or the waiter took away the plate after the guest permitted it. The waiter then manually separated the waste using separate containers for edible and non-edible plate waste. A researcher was present during the whole breakfast period and supervised the correct waste collection and separation procedure. At the end of the collection period, the waste was pooled and weighed with an industrial scale by the researcher.

4.1.3.3. Implementation of guest surveys. The guest surveys were conducted after both the baseline and test phases. To ensure that the guests had sufficient exposure to the breakfast selection and the communication tools, only those guests who had already spent at least three days in the hotel were considered. The guests were issued a paper questionnaire on the last day of each data collection phase. They were approached when leaving the restaurant after breakfast to eliminate a potential bias. The attitudes of guests towards sustainable food and food waste were assessed by using seven-point measurement scales for a total of 20 items. This multidimensional approach was developed by Lund-Durlacher et al. (2016). The questionnaire items refer to all five pillars of the sustainable food concept, i.e., ecology, economy, society, health, and culture.

The differentiation of five pillars builds on von Koerber (2010). His framework enlarges the three-pillar concept of environment, economy, and society as advocated e.g., by the famous Brundtland report. Overall, however, selectivity and clearness of the three-pillar approach are limited and encourage adaptations to the distinct circumstances of different application areas (Purvis et al., 2018).

The subsequent items asked guests about their own perceived food consumption behaviour during the holiday and collected socio-demographic and other guest data such as number of days already spent in the hotel, age, gender, country of origin, party size, and education level. The ex-post questionnaire after the test phase was identical to the ex-ante questionnaire, but additionally asked for the guests' attention to each of the communication tools using a four-point scale.

4.1.4. Phase 4: data analysis

For the statistical analyses, the program SPSS Statistics 24 was used. Due to the quasi-experimental design, it was of particular importance to identify changes in potentially confounding covariates.

4.1.4.1. Analysis of context covariates. The guest data available from the hotel were compared between the baseline and test phases to identify significant differences. Of particular interest were the guests' countries of origin, since Juvan et al. (2018) found that guest nationality had a significant impact on food waste behaviour. While the share of the other guest groups (ranking by share: Germany, United Kingdom, Sweden, Norway, Denmark, other countries) did not change significantly, a significant difference concerned the percentage of Dutch guests, which was higher in the test phase. To get an indication of any food waste behaviours particular to this group, a comparison of the survey data was conducted between Dutch guests and other guests. Based on chi-squared tests, no indication was found that Dutch guests would display a significantly more environmentally conscious food waste behaviour ($p > 0.05$ for all questionnaire items related to food waste). Therefore, we conclude that this variation in guest nationality does not challenge the test results. Other covariates such as mixture of board arrangements, number of buffet stations, and guest presence in the breakfast area did not differ between the baseline and test phases.
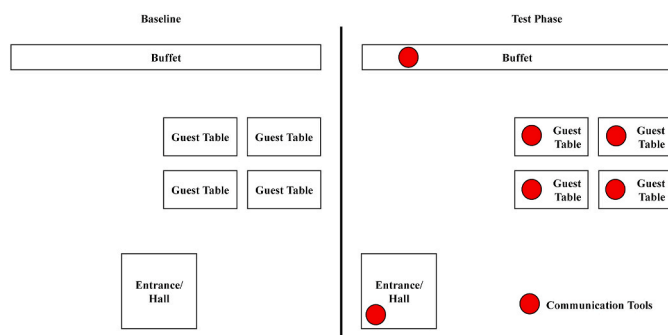

Fig. 3. Experimental lay-out.

4.1.4.2. Analysis of survey covariates. Although the survey participants were comparable along socio-demographic data between the baseline and test phases, as expected with a quasi-experimental design they were not identical. An overview of survey participants' characteristics can be found in Table 2.

One significant difference between the baseline and test phases concerned the average number of days guests had spent in the hotel leading up to the date of the survey. However, spearman correlations with the waste-related survey items gave no indication that environmentally conscious food waste behaviour might have increased because guests had on average already spent more days in the hotel in the test phase. Accordingly, we conclude that the change does not challenge the test results. In contrast, there was no considerable change in the moderately positive attitude of guests towards food sustainability (Appendix A). Overall, the consent to pro-sustainability statements was 4.90 in the baseline phase and 5.10 in the test phase, while the consent to statements contra-sustainability was 3.77 in the baseline phase and 4.10 in the test phase. The analysis of the single statements shows only one significant change (*p* (one-tailed) < 0.05) concerning the importance of traditional food, which was valued more highly by participants of the ex-post survey.

5. Results

After assessing the influence of the covariates, the data were further analysed with reference to the research questions.

5.1. Change in food waste behaviour

To check the effect of the communication tools on the amount of edible plate waste, the waste values of the baseline and the test phase were compared. The measurement results show that the average amount of edible plate waste per guest was lower during the test phase (-14.39%). The mean amount of edible plate waste in the ex-ante (control) group was 18.39 g (SD: 2.99) and in the ex-post (treatment)

group 15.74 g per guest (SD: 2.36). A *t*-test shows that the difference between the phases was significant (*t* (12) = 1.84, *p* (one-tailed) = 0.046) (Table 3).

5.2. Attention towards the communication tools

The survey results show that the tools at the tables of the restaurant achieved the highest attention, as they were read in detail by a majority of the guests. The tool at the restaurant's entrance was noticed by a majority of guests, but only a minority read it in detail. The tools at the buffet were also noticed by a majority of guests, but there remained a high percentage of guests who did not notice them at all (Table 4).

A Friedman test confirmed that the differences in attention to the tools between the three contact points were significant (n = 66, χ^2 (2) = 35.4, *p* = 0.000, *p* < 0.05). Specifically, Wilcoxon post hoc tests (significance level after Bonferroni correction set at *p* < 0.017) showed significant differences between the contact points 'guest table' (mean: 3.33) and 'entrance' (mean: 2.52; *z* = −5.218, *p* = 0.000, *r* = 0.45) and between 'guest table' and 'plate issuance' (mean: 2.44; *z* = −4.241, *p* = 0.000, *r* = 0.37), while the results between 'entrance' and 'plate issuance' were not significantly different (*z* = −0.457, *p* = 0.648, *r* = 0.04) (Field, 2005).

6. Discussion

Relating the results to the propositions of the ABC theory, one can conclude that even in a context that is generally unfavourable to environmentally conscious consumption, well-positioned contextual manipulations can stimulate food waste reduction behaviour. In this study, the stimulation was achieved under conditions of moderately pro-sustainability attitudes in a moderately contra-sustainability context. Under these conditions, a small change in context was sufficient (Fig. 1), while a change in attitudes was not a necessary condition for an increase in more responsible behaviour. This result supports H 1, is consistent with the propositions of the ABC theory (Guagnano et al., 1995; Whitehair et al., 2013), and extends the explanatory power of the ABC theory to food waste behaviour in hotels. Encouragingly, even such a rather less sustainable setting is not an insurmountable barrier to behaviour change. With respect to nudging theory, the conclusion of Stöckli et al. (2018) on the effectiveness of antecedent interventions combining information and prompts is confirmed.

As argued by Stern (2005), it was the context manipulation that caused the behaviour change. Attitudes, in turn, did not change and consequently had no direct effect on behaviour. While Guagnano et al. (1995, p. 704) find that "the main effect of attitudes on behaviour depends on external conditions", this study finds a direct context effect which is potentially moderated by attitudes. To finally confirm the role of attitudes and measure the extent of their effect, however, the test should be repeated in a similar setting with socio-demographically similar guests who possess negative attitudes towards food waste

Table 2
Sample characteristics of the guest survey.

	Ex ante sample	Ex post sample
final sample size	65	66
av. no. of days spent in the hotel (including test day)[a]	6.9	8.2
age distribution (years)	18 - 25: 31.3%	18 - 25: 28.8%
	26 - 35: 20.3%	26 - 35: 16.7%
	36 - 45: 4.7%	36 - 45: 6.0%
	46 - 55: 23.4%	46 - 55: 37.9%
	56 - 65: 9.4%	56 - 65: 7.6%
	n.a.: 10.9%	66 - 75: 1.5%
		n.a.: 1.5%
Gender	male: 46.2%	male: 37.9%
	female: 47.7%	female: 57.6%
	n.a.: 6.1%	n.a.: 4.5%
country of origin	Germany: 33.9%	Germany: 24,3%
	Netherlands: 3.1%	Netherlands: 12.1%
	Sweden: 21.5%	Sweden: 13.6%
	United Kingdom: 16.9%	United Kingdom: 22.7%
	other: 24.6%	other: 27.3%
av. travel party size (only if stated)	2.3	2.5
education	compulsory school degree: 1.5%	compulsory school degree: 4.5%
	completed apprenticeship: 16.9%	completed apprenticeship: 12.1%
	high school degree: 30.8%	high school degree: 25.8%
	university degree: 29.2%	university degree: 40.9%
	n.a.: 21.6%	n.a.: 16.7%

[a] Denotes significant difference at the 5% level.

Table 3
Waste measurement.

Day	Baseline edible plate waste per guest in g	Test Phase edible plate waste per guest in g	Δ Test Phase – Baseline per guest in g	Δ Test Phase – Baseline per guest in %	sig. (one-tailed)
1	13.84	13.03	-0.81	-5.85	
2	18.72	16.46	-2.26	-12.08	
3	20.86	12.02	-8.84	-42.41	
4	21.34	18.06	-3.28	-15.39	
5	20.32	17.27	-3.05	-15.02	
6	18.99	17.76	-1.23	-6.47	
7	14.65	15.61	0.96	6.53	
Average	**18.39**	**15.74**	**-2.65**	**-14.39**	**0.046**

Table 4
Attention towards the Communication Tools (four-point scale, multiple choice question: "Please state the extent you got in touch with the following instruments.").

Tool	I read it in every detail.	I had a closer look at it.	I have noticed it.	I have not noticed it.
Tool 1 (Roll-up at the restaurant entrance)	19.7%	22.7%	47.0%	10.6%
Tool 2 (Display at the guest tables)	57.6%	22.7%	15.2%	4.5%
Tool 3 (Display at the plate issuance)	24.2%	21.2%	28.8%	25.8%

prevention and sustainability in general. This would also allow for implications with which guest clientele the communication tools are effective.

Accordingly, the conclusion of Dolnicar et al. (2017, p. 8) that "pro-environmental appeals are ineffective in hedonic [holiday hotel] contexts" cannot be confirmed. Rather, the results are in line with the successful intervention in Dolnicar et al. (2020). One possible explanation is that the experimental conditions - as represented by the various control variables - did not allow for the intervention to be successful in Dolnicar et al. (2017), whereas favourable conditions prevailed in Dolnicar et al. (2020) and in the present study.

With regard to the ABC theory, it could also be hypothesised that in Dolnicar et al.'s (2017) study, the attitude-context relationship was not favourable for behaviour change. For example, if both factors had a negative value (negative attitude of the guests and a hedonistic hotel context), the minimal context manipulation would likely be ineffective.

With regard to the second research question, it could be shown that the attention towards the communication tools depends on their positioning and that the contact point 'guest table' received the highest attention. It follows that H 2 is also supported. A possible explanation could be that guests only have limited receptivity to 'non-hedonistic' disturbances while they are on their way to the restaurant or help themselves at the buffet. However, when they are seated at their table, they have sufficient time to read and process the messages. This result confirms the importance of positioning for the effectiveness of pro-environmental appeals in hedonistic contexts (Hansen and Maaloe Jespersen, 2013).

It could be hypothesised that in the context of a buffet style hotel restaurant, which constitutes a novel environment compared to the home context, tourists are more receptive to environmental information and therefore more likely to adapt their habitual and possibly wasteful eating behaviour (van't Riet et al., 2011). However, to test this hypothesis, the effectiveness of interventions would also need to be tested in the tourists' home context. The type of intervention would then have to be adapted to the different conditions.

From a business perspective, it should be noted that although the use of the communication tools resulted in less food waste, the surveyed tourists did not perceive their food consumption to be lower during the test phase. It can be concluded that the tools did not affect the hedonistic travel experience of the guests. This can be seen as an important prerequisite for the success of environmental interventions in the holiday context.

Hotels can furthermore benefit directly from the results by saving food resources through a cost-effective measure. Communicating that their food policies are environmentally friendly can also be an effective way for hotels to highlight their corporate responsibility efforts. Since the tools on the guest tables received the highest attention, cost-conscious hotels could focus on this contact point for communicating environmental information.

With regard to the wider sustainability discourse, the findings argue for a stronger consideration of and trust in consumers in exercising responsibility and their inclusion for environmental protection. Likewise, however, the direct context effect shows that consumer agency should not be overestimated relative to structure. Accordingly, a shared responsibility is necessary between hotels as providers of the scope of action and consumers as the agents acting within that scope.

One lesson for future research is that under certain conditions a restraining effect of context can be overcome. The need for these conditions must be corroborated in future studies. For example, different attitude-context combinations could be evaluated in a comparative design. Another lesson is that attitudinal changes should not be expected in the short-term and longitudinal studies are needed to examine the long-term effects of communication tools on attitudes and related behaviours. Future research should further investigate the influence of social norms, and in particular isolate the effect of descriptive norms, i. e., how other guests behave. In addition, the messages themselves could be deconstructed in research that focuses on which specific aspect of the messages was most effective in persuading consumers to change their behaviour. Finally, the durability of the moderate reduction in food waste should be assessed with a longer test series.

7. Limitations

As the study aimed to investigate a causal relationship between communication tools and guest behaviour, it was crucial to control for all other confounding influences to ensure internal validity. Although an attempt was made to identify all possible influencing variables listed in the literature, there is no absolute certainty that this list is exhaustive. In this regard, the greatest validity threat arises from the quasi-experimental design because, although the measured socio-demographic differences between the groups were small, the possibility of influence from other unmeasured differences remains.

Another threat to validity arises from the use of a questionnaire to assess tourists' attitudes towards sustainability. However, although social desirability bias cannot be completely ruled out, the questionnaire items were formulated in such a way that a sustainable attitude was always associated with costs for the consumer (e.g., "Hotels should not only meet but exceed ecological standards […], even if it results in higher prices for me."). This approach aimed to raise the threshold required for guests to report a sustainable attitude.

Finally, the generalisability of the results is limited as the experiment was only conducted in one hotel at one destination. However, Gran Canaria can be considered a typical package holiday destination, and the study site was a typical sun-and-beach holiday hotel with an all-you-can-eat concept. Therefore, the results should be largely transferable to other mass holiday destinations.

8. Conclusion

The results show the effectiveness of the selected communication tools in promoting food waste reduction among hotel guests in all-you-can-eat sun-and-beach holiday hotels. The context manipulation had an immediate decreasing effect on the amount of edible plate waste. With respect to the attitude-behaviour-context theory, the context change caused by the communication tools was strong enough to lift the overall attitude-context combination above the behavioural threshold (Fig. 1).

Furthermore, it can be concluded that 'guest table' is by far the strongest contact point and placing the tools there had a medium effect on recognition (Cohen, 1988). Accordingly, the tools on the 'guest table' bear the main responsibility for the behaviour change.

Since the communication tool on the table achieved the highest recognition values, it can be assumed that this recognition is a function of the exposure to the tool. In addition, the fact that a majority of guests read the tool's message in full detail indicates processing of the message and thus that reducing environmental impact was an intentional, rational decision of guests. Similarly, there is little evidence of subconscious behaviour, which is the target of many 'classical' nudging

interventions.

It is notable that the hotel guests showed receptivity to messages that ran contrary to their other contextual experience. Given their pro-sustainability attitudes, their environmentally conscious food waste behaviour may also be a means of reducing their cognitive dissonance, so that they tried to make the context more environmentally sustainable through their own behaviour.

The findings confirm previous studies from the food service industry that guests reduce their environmental impact when encouraged to do so through informational prompts. This is promising, considering that many food service operations are currently environmentally unsustainable and that their scope for major operational change is often limited.

Overall, the results support the hypothesis that consumers can be encouraged to behave more responsibly through specific graphic and written communication tools. This is true even in unrestricted consumption contexts, provided that the communication tools are placed at the most visible contact points. These results can be used by the hotel industry and policy makers to engage their guests more actively in addressing environmental challenges.

CRediT authorship contribution statement

Hannes Antonschmidt: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. **Dagmar Lund-Durlacher:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

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

Appendix. Survey Results – Attitudes towards Sustainable Food (average on a 7-point Likert scale from 1 = I totally disagree to 7 = I totally agree)

Statement/Question	Baseline Phase	Test Phase	sig. (one-tailed)
On vacation, freshly-prepared food without any convenience products is important to me.	5.77	5.97	0.334
On vacation, buffets and à la carte orders should always provide the complete range of food and drinks until the end of the opening hours, regardless of any leftovers.	4.84	5.02	0.427
Hotels should not only meet but exceed ecological standards (e.g. responsible waste and sewage handling), even if it results in higher prices for me.	5.28	5.31	0.437
On vacation, I like to enjoy food and drinks that are tasty and filling. All other food qualities play a secondary role.	4.26	4.80	0.095
Hotels should not only meet but exceed social standards (e.g. working conditions for employees), even if it results in higher prices for me.	5.78	5.63	0.125
On vacation, I prefer a decent meal regardless of any leftovers.	3.89	4.08	0.365
To reduce waste, I am willing to take smaller portions and go more often to the buffet.	6.03	6.40	0.102
On vacation, I am eager to taste local food.	5.37	5.67	0.399
Consuming local food and drinks is a good way to become acquainted with other cultures.	5.65	5.97	0.108
On vacation, I don't mind eating in an unhealthy way.	3.22	3.58	0.205
On vacation, eating regionally-produced food is important to me.	4.86	5.17	0.094
On vacation, eating freshly-produced food is important to me.	6.00	6.26	0.117
On vacation, eating healthy food is important to me.	5.31	5.70	0.126
On vacation, eating traditional food is important to me.	4.49	5.05	0.017
On vacation, eating fair-trade food is important to me.	4.80	4.85	0.426
On vacation, I like to be informed about the origins and production of food and drinks (e.g. notes in the menu or signs at the buffet).	4.54	4.45	0.231
On vacation, eating fast food (e.g. French fries, burgers, or schnitzel) is essential for me to enjoy myself.	2.65	3.03	0.097
On vacation, eating organic food is important to me.	3.69	3.78	0.492
On vacation, I pay attention to ingredients and nutritional values of meals.	3.97	3.81	0.089
On vacation, I try to eat little or no meat at all.	1.97	2.44	0.182

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Hannes Antonschmidt is a Professor of International Hotel Management at SRH Berlin University of Applied Sciences, Dresden School of Management (Germany). His academic background is in Socioeconomic Sciences. He earned his PhD at Modul University Vienna (Austria). Hannes' research interests are sustainability in tourism and hospitality, consumer behaviour, and advanced quantitative methods. He has participated in multiple basic and applied research projects for the travel industry.

Dagmar Lund-Durlacher is a Professor Emerita at the Department of Tourism and Service Management at Modul University Vienna and Senior Research Associate at the Centre for Sustainable Tourism at the Eberswalde University for Sustainable Development. She earned her PhD at the Vienna University of Economics and Business. Between 2010 and 2014 she chaired the BEST (Building Excellence in Sustainable Tourism) Education Network, and is scientific and technical advisor for a number of international industry and non-profit organizations. Her current research interests focus on the areas of corporate social responsibility emphasising on CSR management systems and certification schemes, climate change and mobility in tourism as well as sustainable food operations.