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SDG-Kategorie²:

- SDG 1: **Armut** in all ihren Formen und überall beenden
- SDG 2: Den **Hunger** beenden, **Ernährungssicherheit** und eine bessere **Ernährung** erreichen und eine nachhaltige **Landwirtschaft** fördern
- SDG 3: Ein **gesundes Leben** für alle Menschen jeden Alters gewährleisten und ihr Wohlergehen fördern
- SDG 4: Inklusive, gleichberechtigte und hochwertige **Bildung** gewährleisten und Möglichkeiten **lebenslangen Lernens** für alle fördern
- SDG 5: **Geschlechtergerechtigkeit** erreichen und alle Frauen und Mädchen zur Selbstbestimmung befähigen
- SDG 6: Verfügbarkeit und nachhaltige Bewirtschaftung von **Wasser und Sanitärversorgung für alle** gewährleisten
- SDG 7: Zugang zu bezahlbarer, verlässlicher, nachhaltiger und moderner **Energie** für alle sichern
- SDG 8: Dauerhaftes, breitenwirksames und nachhaltiges **Wirtschaftswachstum**, produktive **Vollbeschäftigung** und **menschenwürdige Arbeit** für alle fördern
- SDG 9: Eine widerstandsfähige **Infrastruktur** aufbauen, breitenwirksame und nachhaltige **Industrialisierung** fördern und Innovationen unterstützen
- SDG 10: **Ungleichheit** in und zwischen Ländern **verringern**
- SDG 11: **Städte und Siedlungen** inklusiv, sicher, widerstandsfähig und nachhaltig gestalten
- SDG 12: Nachhaltige **Konsum- und Produktionsmuster** sicherstellen
- SDG 13: Umgehend Maßnahmen zur **Bekämpfung des Klimawandels** und seiner Auswirkungen ergreifen
- SDG 14: **Ozeane, Meere und Meeresressourcen** im Sinne nachhaltiger Entwicklung erhalten und nachhaltig nutzen
- SDG 15: **Landökosysteme** schützen, wiederherstellen und ihre nachhaltige Nutzung fördern, **Wälder** nachhaltig bewirtschaften, **Wüstenbildung bekämpfen**, **Bodendegradation beenden und umkehren** und dem Verlust der **biologischen Vielfalt** ein Ende setzen
- SDG 16: **Friedliche und inklusive Gesellschaften** für eine nachhaltige Entwicklung fördern, allen Menschen **Zugang zur Justiz** ermöglichen und leistungsfähige, rechenschaftspflichtige und inklusive **Institutionen** auf allen Ebenen aufbauen
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³ Zentrale Begriffe zur inhaltlichen Erfassung der wesentlichen behandelten Aspekte.

Adoption and Implementation of Sustainability Innovations in the Hotel Industry – The Case of Sustainable Food

by

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Dissertation submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Business and Socioeconomic Sciences in the Department of Tourism and Service Management in the Post-Graduate School of MODUL University Vienna.

2019

ABSTRACT

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ABSTRACT

The globalization age is accompanied by increasing variability, risk, and insecurity caused by a relative loss of nation states' power towards market actors. Consequently, consumers and corporations under the prevailing societal and political conditions possess a significantly higher agency which they could exercise for the achievement of sustainability goals. One strategy in this respect is the adoption and implementation of sustainability innovations since these have been confirmed to improve the economic, social, and ecological balance of private businesses and can be considered effective connectors that link economic success with sustainability. However, despite these advantages of sustainability innovations, the hotel industry remains innovation-cautious, and the adoption and implementation of sustainability innovations are relatively rare.

The aim of this dissertation is to find out if and under which conditions an increased adoption and implementation of the concept of 'sustainable food' as an example of a sustainability innovation appears possible. Sustainable food is a multidimensional concept consisting of the meta-categories 'individual and health', 'society', 'economy', 'environment', and 'culture'. At the level of investigation, the dissertation adopts both an industry and a micro perspective to evaluate the potential for innovation adoption and implementation on the part of the hotel industry and its customers.

Accordingly, the aim of the first study of the dissertation is to clarify what sustainable food is and what its implications for all-inclusive holidays are. This study builds on a qualitative design and attains existing definitions of sustainable food via a systematic narrative literature review. Subsequently, a comparison of the concept of sustainable food to the characteristics of all-inclusive holidays is conducted. The study finds that all-inclusive holidays, in their current form, cannot be considered sustainable with respect to food. The adoption and implementation of sustainable food practices would imply considerable changes in the business model of hotels offering these products. Consequently, sustainable food can be considered a radical innovation for mass holiday resorts.

The second study identifies determinants of sustainable food travel product choices in order to improve the predictability of these choices. For this purpose, a support vector machine model and a logit model are developed using the same dataset, and the models are compared. Both models reach an equally moderate overall prediction accuracy while their specific performances show some differences, e.g. regarding the recognition of positive cases. It is concluded that support vector machine models in practice can be used for high-dimensional, non-linear and very specific analytical problems, while primary field of application for logit model should be low-dimensional problems with thematically distant predictors. For a problem that ranks between

these ideal cases, such as the case at hand, both models can be applied and complement one another.

Finally, the aim of the third study is to assess the demand side and to provide insight into the willingness of customers to adopt sustainable food practices at the point of consumption. Building on Stern's Attitude-Behaviour-Context theory, the study uses a quasi-experimental design to test the impact of communication tools using an informational prompt as a stimulus for inducing sustainable guest behaviour in a hedonic context that generally discourages sustainability. The results proved the effectiveness of the communication tools, represented in a reduction in food waste. A possible explanation is that the stimulus was successful in activating latent sustainable consumer attitudes which then outweighed the motivation for overconsumption stemming from the all-you-can-eat context.

To summarize the results of the three studies, it can be concluded that a shift towards an increasing adoption and implementation of radical sustainability innovations such as sustainable food only appears possible as a result of a simultaneous effort by consumers and hotels. Consumers need to actively demand sustainable food practices from hotels and adjust their consumption behaviour accordingly. At the same time, hotels should be more receptive to their socioeconomic environment and actively integrate their guests into the handling of societal sustainability challenges.

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LIST OF ABBREVIATIONS

ABC	Attitude-Behaviour-Context
CO ₂	Carbon Dioxide
CSR	Corporate Social Responsibility
GDP	Gross Domestic Product
kt	Kilotons
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
SME	Small and Medium-sized Enterprises
SMOTE	Synthetic Minority Over-sampling Technique
SO ₂	Sulfur Dioxide
SPSS	Statistical Package for the Social Sciences
SVM	Support Vector Machine

1. INTRODUCTION

Natural resources occupy a tragic role in tourism. On the one hand, they can be attractive destinations that may motivate people to visit a place (Urry, 1995). On the other hand, the establishment and operation of tourism businesses, such as hotels, consume a considerable amount of these natural resources and can therefore endanger their continuous existence (Singal, 2015). Likewise, tourism businesses rely more on human resources than other businesses, yet also have a high potential to negatively impact the social balance within a given area, e.g. through disruptions of local labour and commodity markets or insufficient contributions to income for the local community (Torres, 2003).

Meanwhile, studies report a rising consumer demand for so-called sustainable tourism products; i.e., products which show a positive environmental and social balance (Berezan, Raab, Yoo, & Love, 2013). Sustainability efforts on the part of tourism businesses have also had a positive impact on customers' willingness to pay (Kang, Stein, Heo, & Lee, 2012), overall guest satisfaction and return intention (Berezan et al., 2013), and hotels' financial performance (Walsman, Verma, & Muthulingam, 2014). Lastly, making their own products and services more sustainable is a way for hotels to comply with existing or prevent future environmental as well as social regulation (Levy & Park, 2011).

Conserving their natural and social resource base can therefore be considered a rational strategy for hotels to achieve economic sustainability, and to secure the long-term value creation potential of their business model (Saarinen, 2006; Bohdanowicz, 2005). The practical connection of economic success and sustainability, however, still constitutes a major challenge for businesses (Schaltegger & Synnestvedt, 2002); consequently, they are in need of effective connectors between the two spheres. Sustainability innovations can be considered one such effective connector (Rantala, Ukko, Saunila, & Havukainen, 2017). While an innovation can generally be defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p.12), a sustainability innovation additionally "improves sustainability performance, where such performance includes ecological, economic, and social criteria" (Boons, Montalvo, Quist, & Wagner, 2013, p. 2).

Innovations are regarded as critical for hotels to achieve advantages in an increasingly competitive market environment (Horng, Wang, Liu, Chou, & Tsai, 2016). Accordingly, innovative firms demonstrate better operational and financial performances (Nelson & Winter, 1977; Lin, Tan, & Geng, 2013). This finding is confirmed for product, marketing, process, and organizational innovations (Gunday, Ulusoy, Kilic, & Alpkan, 2011; Fraj-Andrés, Martínez-Salinas, & Matute-Vallejo, 2009) and holds true for the service sector in general (Chen, Tsou, & Huang, 2009) and the hotel industry in particular (Martínez-Román, Tamayo, Gamero, & Romero, 2015; Orfila-Sintes & Mattsson, 2009).

However, despite the potential benefits of an innovation strategy, the sector is described as innovation-cautious (Hjalager, 1997; Hjalager, 2002; Hjalager, 2010; Martínez-Ros & Orfila-Sintes, 2009; Sundbo, Orfila-Sintes, & Sørensen, 2007). Likewise, adoption and implementation of new sustainable practices remain comparatively rare (Prud'homme & Raymond, 2013), contradicting other theoretical and empirical studies that claim that increased market demand leads to increased innovation activity (Rennings, 2000; Hansen, Grosse-Dunker, & Reichwald, 2009; Kesidou & Demirel, 2012; Hojnik & Ruzzier, 2015; Lin et al., 2013).

In the light of this situation, the aim of this dissertation is to find out if and under which conditions an increased adoption and implementation of sustainability innovations appears possible, employing the concept of 'sustainable food', a multidimensional concept based on the pillars 'individual and health', 'society', 'economy', 'environment', and 'culture' as an example. Explanations are expected to stem from an examination of the main determinants that are presumed to influence innovation behaviour - the innovation itself and the adopting as well as implementing entities on both the demand and supply side (e.g. Rennings, 2000; Hansen et al., 2009; Dewett, Whittier, & Williams, 2007; Rogers, 2003; Damanpour, 1991). Accordingly, this dissertation investigates the concept of sustainable food and its implications for a typical package holiday product (study one), assesses factors that determine its adoption by customers (study two), and measures the potential of a stimulus to increase its adoption rate at the point of sale (study three).

The structure of this dissertation follows a course from generic to specific. After a brief prologue on the relevance of private businesses for sustainability, the epistemological standpoint and methodological approach are described, before the focus is gradually narrowed down to sustainability innovations, sustainable food, and the hotel industry. Based on this preamble, the research questions are introduced which are subsequently validated within the three empirical studies.

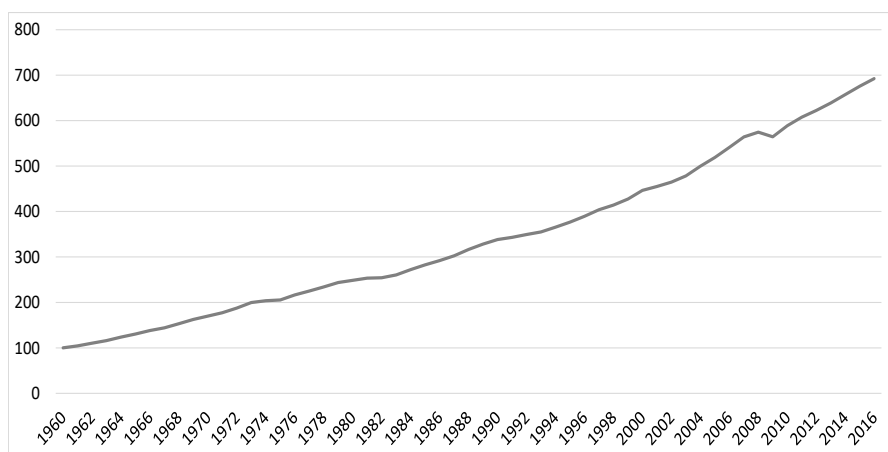
2. PROLOGUE - RELEVANCE OF PRIVATE BUSINESSES FOR SUSTAINABILITY

In a capitalist economy, private business behaviour can be characterized as nearly exclusively oriented towards economic growth. If social and environmental concerns are taken into account, they are usually traded off against this economic imperative. Nonetheless, firms depend on the natural and social environment for the provision of inputs such as raw material and labour, and the disposal of outputs such as consumer products and services, waste and other externalities (Hawken, Lovins, & Lovins, 2008).

The one-sided growth orientation of capitalist economies has led to the paradoxical situation in which the provision of the global population with material goods and a general increase in living conditions of people worldwide were achieved, yet, at the same time, the resulting wealth was spread unevenly, lowering social cohesion or even causing distributional conflict (Hawken et al., 2008; Milanovic, 2009; Coburn, 2000; Fig. 2.1; Fig. 2.2; Fig. 2.3). The overuse and exploitation of natural resources has furthermore led to inter alia environmental degradation, loss of biodiversity, and excessive emissions (Daly & Cobb, 1994; Fig. 2.4; Fig. 2.5). Finally, the commodification of wage labour as an easily replaceable economic resource has provided negative incentives for its utilization, partly obliterating the general increases in living conditions (Giddens, 1991).

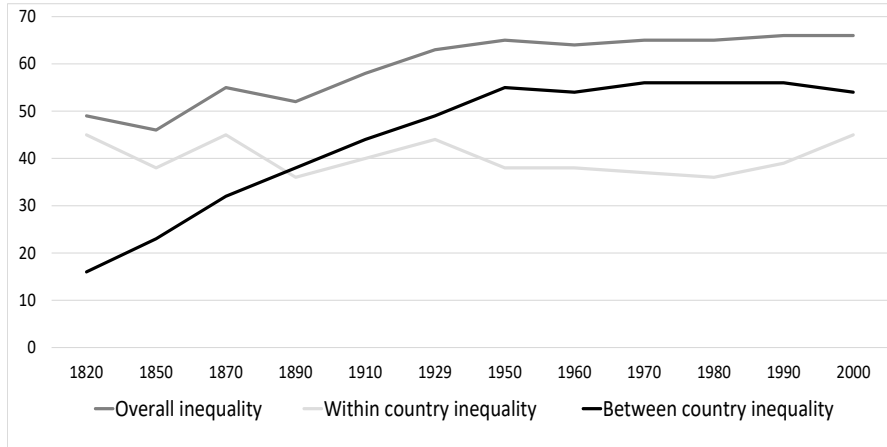
Empirical research confirms the observation of negative effects of especially early industrialization on CO₂ and SO₂ emissions, and biodiversity. However, at the same time, there is support for the hypothesis of an environmental Kuznets curve implying an inverted U-shaped relationship between economic development and environmental degradation. In Western Europe, this hypothesis holds at least for SO₂ emissions and species abundance (Klein Goldewijk, 2014).

FIG. 2.1: WORLDWIDE ECONOMIC DEVELOPMENT SINCE 1960 (GDP IN CONSTANT 2010 US\$, 1960 = 100)



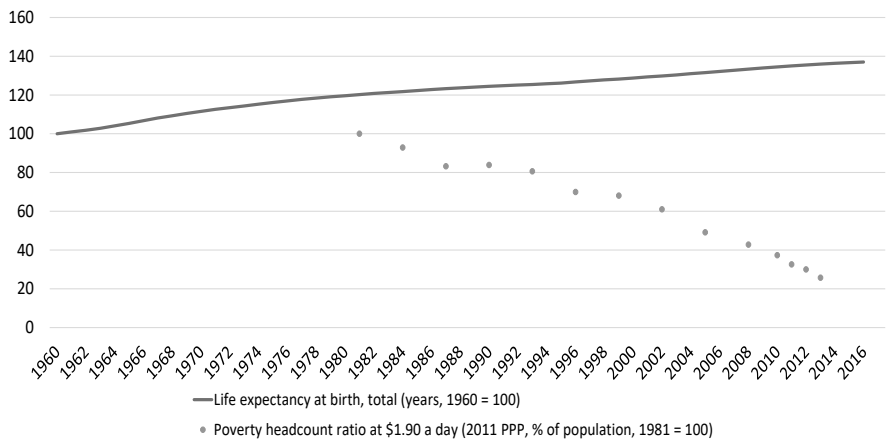
Source: World Bank (2018b)

FIG. 2.2: WORLDWIDE INEQUALITY SINCE 1820 (GINI COEFFICIENT)



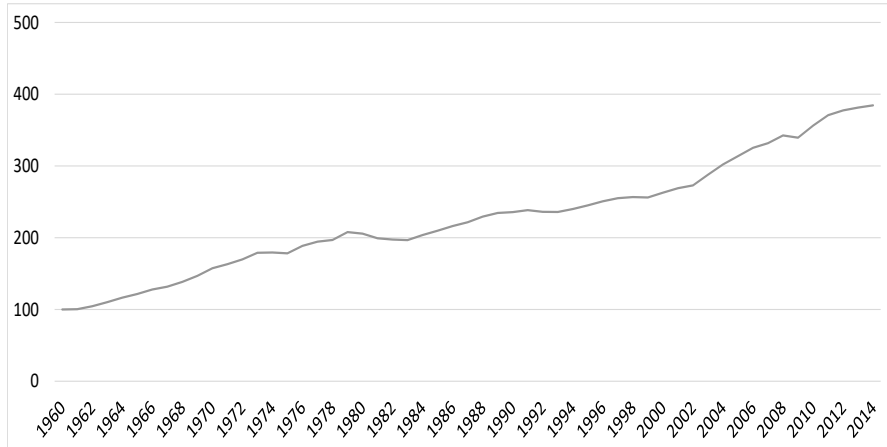
Source: Moatsos, Baten, Foldvari, van Leeuwen, & van Zanden (2014), p. 208

FIG. 2.3: WORLDWIDE LIFE EXPECTANCY/POVERTY DEVELOPMENT



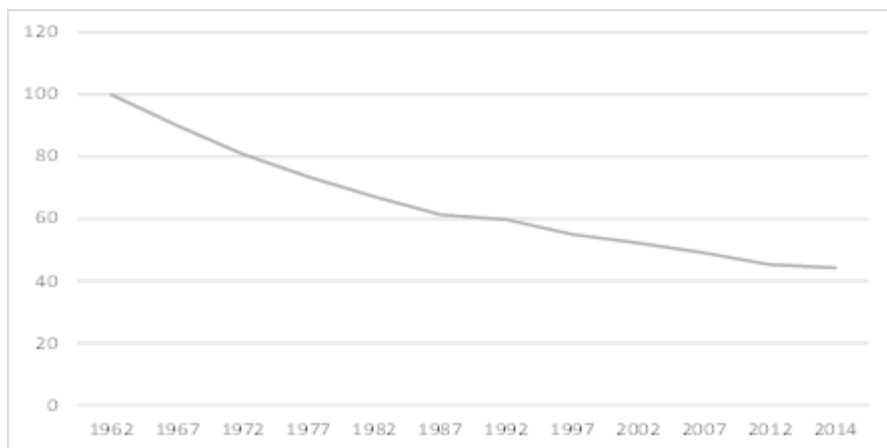
Source: World Bank (2018c, d)

FIG. 2.4: WORLDWIDE CO₂ EMISSIONS (KT, 1960 = 100)



Source: World Bank (2018a)

FIG. 2.5: WORLDWIDE RENEWABLE INTERNAL FRESHWATER RESOURCES PER CAPITA (M³, 1960 = 100)

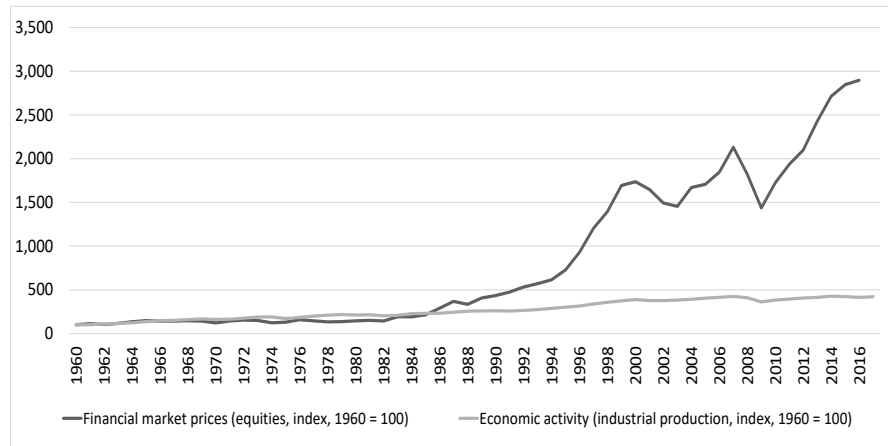


Source: World Bank (2018e)

One reason for this detrimental tendency is a lack of economic incentives for behavioural change, as for many resources no or only inadequate market prices can develop (problem of externalities) (Samuelson & Nordhaus, 2006). In recent decades, this tendency has emerged through deregulated markets that have made the worldwide transfer of resources relatively easy, increasing the power of multinational corporations relative to the state in particular (Johnstone & Newell, 2018). This power shift, combined with the pressures of a deregulated financial economy, has encouraged firms to seek short-term and often unsustainable strategies such as *inter alia* outsourcing to low-wage and low-regulation countries, mass lay-offs, lack of long-term investment, and excessive tax avoidance (Porter & Kramer, 2011; Passas, 2005). Capital-

market oriented firms have thereby assumed responsibility nearly exclusively for their shareholders, lacking embeddedness into the wider social system or societal institutions (Macaulay, 2015; Clarke, Jarvis, & Gholamshahi 2018).

FIG. 2.6: DEVELOPMENT OF PRIMARY AND SECONDARY ECONOMY (UNITED STATES, 1960 = 100)



Source: *International Monetary Fund (2018)*

This strong orientation towards financial goals has also resulted in a further decoupling of developments in the primary, real economy and the secondary, financial economy, accompanied by a speculation-driven accumulation of money leading to bubbles in important business and consumer markets (Fig. 2.6). In 2007/2008, the bursting of such a bubble in the American real estate market resulted in a worldwide financial crisis (van den Bergh, 2013).

Nevertheless, the struggle of environment and society to cope with rapid economic development is not a new phenomenon. Already in the first half of the 19th century, the French political scientist Alexis de Tocqueville (1958) commented on the unsustainable impact of industrialization apparent in English labour communities. Also Veblen’s description of the dichotomy of pecuniary and production function within free enterprise firms dates back already to the early 20th century (Veblen, 1904). Nonetheless, scale, extent, and pace of the development in the 21st century constitute a unique situation (Beck, Bonss, & Lau, 2003).

2.1 Societal and Political Implications

Of particular relevance for the objectives of this dissertation is the changing role of corporations and consumers regarding sustainability challenges. This changing role cannot solely be addressed with reference to economic developments, but also needs to take the societal changes characterizing the globalization era into account.

The relative gain in authority of markets relative to nation states caused by the decrease in restrictions in the exchange of goods, services, and information has been an important subject of contemporary sociological analysis. This globalization tendency is predominantly interpreted as the beginning of a shift from a 'logic of structure' to a 'logic of flows' (Beck & Beck-Gernsheim, 2001; Giddens, 1991; Held, 2002). Actors, be they states, consumers, employees, or citizens increasingly find themselves reacting to changing market trends. This phenomenon has led to the characterization of the current era as 'reflexive modernity', an epoch that is coined by 'manufactured uncertainty' (Giddens, 1991; Beck et al., 2003).

According to this 'risk society' hypothesis, as a result of the changing structure of the post-industrial economy induced by techno-scientific subsystems, traditional class boundaries have started to blur, accompanied by a loss of traditional social bonds. Former class societies increasingly become market societies in which independent, cosmopolitan individuals shape their own life biographies (Held, 2002). There is less security, but also increased freedom with respect to work and private life. This also affects traditional gender roles and the role of paid work as a status base. Likewise, it creates new standardization through the collective consumption of mass media content, and mass products and services, respectively. The state, reduced in its sphere of influence, struggles to control the changes happening and limits itself to a role as caretaker for social hardship. It transforms towards a reflexive state whose tasks are partly taken over by private actors such as industry associations or charities (Beck, 1992).

Beck (1992) argues that, as a result of this development, the societal consensus on progress and on the legitimacy of the capitalist system to achieve it both economically and socially dissolves increasingly. Instead, a growing recognition sets in regarding the potentially uncontrollable consequences of scientific research for economy, environment, and society. Furthermore, the recognition of the increased interconnectedness of global subsystems creates an awareness that many of the outlined problems can no longer be solved on the national level. This collective consciousness of exposure to fundamental risks, in turn, replaces the traditional bonds of the class society (Beck, 1992).

At the same time, there is no effective, democratically legitimized economic, environmental, or social governance system on a worldwide scale with sufficient enforcement power over the interests of private actors to address these new problems (Held, 2002; Beck, 2009). Instead, a critical "global risk society" (Beck,

1992, p. 41) forms, with a decentralized power structure distributed among public, private, and civil society actors (Beck, 1992; Giddens, 1991).

3. EPISTEMOLOGICAL STANDPOINT

The epistemological standpoint adopted in this dissertation can best be described as located between post-positivism and critical rationalism. The author adheres to the positivist philosophy that reality can be considered as the result of a sequence of phenomena whose causes are invariable, fixed natural laws (Mill, 1865). Consequently, every environmental, social, and economic phenomenon depends on these laws for its further existence and cannot work against them, at least not in the long run.

At the same time, the involvement of human beings, who are natural phenomena themselves, does not tolerate a foundationalist approach to reality, since human behaviour is also shaped by individual, i.e. psychological, and collective, i.e. social, conditions (Eldridge, 1980). Indeed, many social phenomena show fuzzy, irregular characteristics instead of clear-cut, stable ones (Treiblmaier, 2019). In the postmodern age of blurring boundaries between social classes and an increasing involvement of diverse international market actors, it is expected that this fuzziness will further increase.

Similarly, the assumption of value-free research is overturned by the recognition of an unavoidable researcher bias, which acknowledges that corporations, consumers, sustainability, and sustainable food are not only action-oriented and normative, but also socially constructed concepts (Springett & Redclift, 2015). As such, these concepts reflect not only contemporary societal role expectations, but also their own historical development (Giddens, 1991). In this respect, the prevailing societal power structure needs to be taken into account, especially since the research topic investigates politically relevant questions with potentially significant societal implications (Eldridge, 1980).

Acknowledging these limitations of the positivist method, the adopted worldview can appropriately be described as post-positivist (Creswell, 2014) and close to the critical rationalist paradigm of Karl Popper. Consequently, this research aims to logically deduct falsifiable hypotheses from a consistent theoretical base (Popper, 2002). Furthermore, since the research analyses real-world phenomena, it needs to rely on empirical methods. In line with Popper (2002), the author believes that the only way to generate knowledge via empiricism is through experience.

Lastly, following Comte's credo „le véritable esprit positif consiste surtout à voir Pour Prévoir" (1842, p. 13), this dissertation addresses a real-world problem and aims for a pragmatic transformation of the status quo. The instrumental use of science is thereby justified by the moral rightness of the attempt to improve conditions that work against the principles of nature. Likewise, this research is humanistically motivated (Bernard, 2013), and its philosophical position towards sustainability is relatively anthropocentric (Baker, 2006), in that the human being is considered to be a legitimate user of the environment given that its enlightened behaviour does not contradict nature's inherent principles.

4. METHODOLOGY

This dissertation uses a mixed methods design. Mixed methods research can be defined as “an intellectual and practical synthesis based on qualitative and quantitative research” (Johnson, Onwuegbuzie, & Turner, 2007, p. 129). Two main arguments support this choice. First of all, the concept of sustainable food is not well defined or operationalised yet. Therefore, a qualitative study that assesses and evaluates the breadth of the available material regarding the concept seems reasonable. However, a purely qualitative approach would neither be able to unambiguously identify causal relationships, nor could it attempt to statistically test hypotheses, and therefore it would not fulfil the requirements of the post-positivist respectively critical rationalist paradigm. In addition, quantitative methods coincide with the dissertation’s pragmatic orientation towards prediction and change.

Consequently, the qualitative first study informs the specification of the qualities of sustainable food travel products in study two and the choice and design of the experimental manipulation in study three. This type of design, which starts with a qualitative phase, followed by a quantitative phase can be described as exploratory sequential (Creswell, 2014).

Detailed information on the methods used within the three empirical studies is provided in the respective sections in chapter 7.

5. THEORETICAL BASE

The aim of this section is to give an overview of the main concepts, constructs and theories that constitute the framework for the empirical studies within this dissertation. The section provides an overview of the concepts of sustainability, the sustainability-conscious corporation, and the sustainability-conscious consumer. Furthermore, the innovation concept and its relation to sustainability is introduced. Finally, sustainable food as the case example and sustainable tourism as the field of application with the applying actors, consisting of hotels and their guests, are described.

5.1. The Concept of Sustainability

The concept of sustainability refers to a “state or condition that can be maintained over an indefinite period of time” (Du Pisani, 2006, p. 91). Transferred to the economic, social, and ecological systems of the Earth, sustainability calls for a balance between these spheres with the aim of preserving the means of livelihood for present and future generations (Atkinson, Dietz, & Neumayer, 2007; Robertson, 2014; Baker, 2006). The concept of sustainability is closely entangled with the concept of ‘carrying capacity’, meaning to keep the world population at a level that can be supported without eroding the natural environment (Brown, Hanson, Liverman, & Merideth, 1987).

One important distinction can be made between the ‘weak sustainability’ and ‘strong sustainability’ approaches. Weak sustainability can be linked to neoclassical economic theory and assumes resource substitutability between natural and human-made capital (Ruta & Hamilton, 2007). Strong sustainability aims to keep the spheres intact separately, and regards them as complementary (Daly & Cobb, 1994). These positions correspond to the philosophical worldviews of ‘anthropocentrism’ and ‘ecocentrism’, respectively. Both views can be considered extreme ends of the same continuum. From an anthropocentric perspective, nature is mainly a resource or service provider for humans, while the ecocentric view attaches an intrinsic value to nature, placing human and environmental spheres in an equal and reciprocal relationship (Baker, 2006).

Whereas sustainability can be considered a goal, sustainable development can be understood as a process of change (Daly & Cobb, 1994). Depending on the perspective, this change process can allow or reject economic growth. The weak sustainability stream allows for quantitative growth as long as the planet's economic, ecological, and social aggregate capital base is kept constant at varying configurations (Brown et al., 1987). However, it acknowledges that a shift in consumption habits towards more sustainable products and an orientation towards basic needs as opposed to increasing material possessions are necessary (Jackson, 2007). In contrast, advocates of the strong sustainability school of thought aim for a “Steady-

State” (Daly, 1980, p. 12). This concept, developed by the American economist Herman Daly, is a comprehensive closed circle approach to an economy independent of growth. Its total stock of natural, human-made capital and people remains constant, so that input, generated by birth and production, and output, generated by death and consumption of matter and energy, are equal. The concept would make a sharp decrease in consumption necessary, and the economy’s focus would shift from growth towards qualitative changes, and the distribution of the existing stock (Daly, 1980; Daly & Cobb, 1994).

While this focus on the natural environment reflects current public discourse, for development to be sustainable the social and the economic dimensions also need to be considered. Both social and economic sustainability are briefly considered here, keeping in mind that these concepts are to date much less uniformly defined than environmental sustainability.

Issues related to social sustainability revolve around the distribution of power and resources, poverty reduction, and the achievement of increased equality and (intergenerational) justice (Vallance, Perkins, & Dixon, 2011). Similar to the economic dimension, social sustainability can also conflict with environmental sustainability. While the natural environment provides the foundation for the livelihoods of people, a certain threshold in social standards must be exceeded for people to develop the capacity to care for environmental questions. For the developed nations, in turn, maintaining their high living standard can conflict with the need to save resources (Vallance et al., 2011).

Finally, the economic dimension is the third pillar of sustainability; this refers to welfare generation as the basic economic rationale (Lélé, 1991). On the business level, welfare generation is linked to the concept of ‘shared value creation’, which assumes that for value creation to be sustainable, there must be benefits on both sides of the exchange relationship (Carroll & Shabana 2010; Porter & Kramer, 2011). While there is ongoing debate regarding whether or not economic activity can be regarded as a means to automatically achieve also social and environmental development (Vallance et al., 2011), consensus exists that sustainability does not neglect the need for economic activity, but allows it within wider or narrower boundaries (Dyllick & Muff, 2016).

5.2. The Sustainability-Conscious Corporation

The financial crisis of 2007/2008 was followed by a period of fiscal consolidation and reduced public spending in which the responsibility of private businesses in contributing more actively to the handling of emerging sustainability challenges became the focus of the scientific discourse (Hansen et al., 2009; Böcher, 2012).

This question on the wider responsibilities of businesses beyond legal obligations is, however, subject of a long-term debate. In the United States, they date back at least to the 1950s when concepts such as Corporate Social Responsibility (CSR) or sustainability management were developed with the intention to harmonize business models with ecological and social requirements (Baumgartner & Rauter, 2016; Long, Tallontire, & Young, 2015). Likewise, in the last years, a trend towards increased reporting on the sustainability performance of private businesses can be stated (Long et al., 2015), signalling a higher receptivity of businesses towards stakeholder claims for transparency (Murillo-Luna, Garcés Ayerbe, Rivera, 2008). Critics, however, argue that these efforts have not yet led to an integration of sustainability into the core values of private corporations (Long et al., 2015).

Simultaneously, new business approaches were outlined as proactive initiatives by private economic actors to handle sustainability challenges. Taking into account the role of these private actors, Dyllick and Rost (2017), Dyllick and Muff (2016), Visser (2013), and Adams, Jeanrenaud, Bessant, Denyer, and Overy (2016) call for a fundamental shift in thinking about the role of private businesses and advocate a radical change in business models from inside-out thinking (i.e., addressing the question ‘How can the firm improve its sustainability balance?’) to outside-in thinking (i.e., addressing the question ‘How can the firm contribute towards solving pressing sustainability challenges?’).

Dyllick and Muff (2016) differentiate the resulting business models on a scale from sustainability 1.0 to 3.0. ‘Sustainability 1.0’ implies that the - predominantly neoclassical - business model remains the same, while focus is placed on operational changes with the primary intention to improve the creation of shareholder value. Businesses in the ‘Sustainability 2.0’ stage take wider stakeholder claims into account and shift their orientation from the mere creation of economic value to also include environmental and social value. Finally, ‘Sustainability 3.0’ requires a complete shift in perspective, whereby the company’s responsibility is to use its resources first and foremost to address critical sustainability challenges. This classification corresponds to Visser’s (2013) ‘CSR 2.0’ approach and Adams et al. (2016), who distinguish between ‘Eco-Efficiency’, ‘New Market Opportunities’, and ‘Societal Change’.

5.3. The Sustainability-Conscious Consumer

One of the central characteristics of capitalist economic systems is their reliance on individual consumption; i.e., the use of tangible or intangible resources for the maximization of individual benefits. Especially in economically highly-developed nations, this has led to an overconsumption tendency whereby more resources than needed for the achievement of full material supply are consumed. Unsurprisingly, the individual preference for consumption is negatively associated with attitudes towards sustainability

(Stöckigt, Schiebener, & Brand, 2018). Many consumers, especially in economically highly-developed nations, have recognized this negative impact of a resource intensive lifestyle and voluntarily decided to reduce their consumption level (Evans, 2011).

Marketing research has dedicated considerable and increasing research effort to changing consumption styles since the 1990s when ecologically conscious consumption emerged as a mass phenomenon mainly in post-industrialized countries (Roberts, 1996). Increasingly, consumers thereby act as 'citizen consumers' who articulate socio-political convictions in the marketplace and in doing so press for political change (Watkins, Aitken, & Mather, 2015; Hüttel, Ziesemer, Peyer, & Balderjahn, 2017; Spaargaren & Mol, 2008; Spaargaren, 2003; Barr, Gilg, & Shaw, 2011; Ehrgartner, 2018).

Ehrgartner (2018) argues that the exercise of consumer sovereignty can have an impact on the choice architecture provided by producers at the point of purchase. On the other hand, Barr et al. (2011) highlight the perceived powerlessness of consumers in relation to businesses and government. Isenhour (2015) points to the abuse of citizen consumption approaches as a means to unduly externalize collective responsibilities to the individual, lowering the potential for large-scale, institutionalized action. Furthermore, the author argues that the concept of the citizen consumer does not question the inherent logic of the consumption-focused capitalist economic system as such. Finally, it can be argued that consumers are not a homogeneous group with respect to sustainability (Balderjahn, Peyer, Seegebarth, Wiedmann, & Weber, 2018; Grunert, 2019). Accordingly, an analysis of market segmentation studies in tourism reveals that data from survey studies are unlikely to contain natural market segments, i.e. segments that show clear boundaries, with high internal homogeneity and external heterogeneity, and which remain stable over multiple consecutive segmentation analyses (Ernst & Dolnicar, 2018).

However, irrespective of the existence of a homogeneous segment of sustainable consumers, the results of several studies indicate that consumers are willing to shift their consumption habit if they are provided with the necessary information on the consequences of their choice for sustainability. Peschel, Grebitus, Steiner, and Veeman (2016) differentiate between three types of knowledge, namely subjective knowledge (i.e. consumers' perception of their knowledge level), objective knowledge (i.e. what consumers actually know), and usage experience. They find that both subjective and objective knowledge increase the likelihood of consumers making sustainable food choices, while higher usage experience is not associated with more sustainable choices. Stöckigt et al. (2018) show that in shopping situations where consumers are provided with sustainability information on food and fashion products, these sustainability attributes rank highest and second highest, respectively, in importance for consumer decision making.

Wang and Hazen (2016) investigate the effect of cost, 'green' (knowledge on realizable resource-savings), and quality consumer knowledge on purchase intention of remanufactured products using an example of

Chinese consumers. They find no direct effect of any form of consumer knowledge on purchase intention; however, they find an indirect effect, whereby the relationship between consumer knowledge and purchase intention is mediated by perceived value and perceived risk of the product. Green knowledge, cost knowledge, and quality knowledge each enhance the perceived value of the product, with the latter two also reducing its perceived risk.

5.4. Innovations and Sustainability

Schumpeter (2003) considers innovations to be adaptations towards societal changes. These changes may be increases in population or capital, progression in production methods, progression in the economic organization of the industrial society, or development and diversification of consumer needs. Taalbi (2017) adds pressing problems (e.g. environmental or economic) as a further innovation catalyst. To benefit from the changing conditions, entrepreneurs implement new combinations of production factors.

Innovations can take different forms. “Administrative innovations involve organizational structure and administrative processes; they are indirectly related to the basic work activities of an organization and are more directly related to its management” (Damanpour, 1991, p. 560f.). “Technical innovations pertain to products, services, and production process technology; they are related to basic work activities and can concern either product or process” (Damanpour, 1991, p. 560). Another type is marketing innovations (Hjalager, 1997; Hjalager, 2010; Rogers, 2003), which describe innovations aimed at improved fulfilment of customer needs and increased sales through changes of the parameters product, price, promotion, and place. Further differentiation relates to the degree of newness of an innovation. Radical innovations “produce fundamental changes in the activities of an organization and represent clear departures from existing practices” (Damanpour, 1991, p. 561), while incremental innovations “result in little departure from existing practices” (Damanpour, 1991, p. 561.).

Before an innovation becomes a regular practice, it needs to pass several stages. Rogers (2003) groups these stages into innovation creation, i.e. discovery and development of the innovation to market standards, innovation adoption, i.e. the “decision to make full use of an innovation as the best course of action available” (Rogers, 2003, p. 177), innovation implementation, i.e. the actual use of the innovation, and innovation diffusion, i.e. the process “by which [...] an innovation [...] is communicated through certain channels [...] over time [...] among the members of a social system” (Rogers, 2003, p. 11).

One major trigger for innovations is governmental regulation (Verspagen, 2005). New regulations, in accordance with the resource-based view of the firm, challenge firms to remain competitive under altered conditions (Porter & van der Linde, 1995; Hansen et al., 2009). This ‘regulatory push’ induces the adoption

and implementation of innovations as they can be considered a means to simultaneously achieve compliance and competitiveness (Boons et al., 2013). Another major driver for innovations can be the opportunity to target new market segments and to fulfil the (latent or manifest) customer demand for new products ('market pull') (Rennings, 2000; Hansen et al., 2009). Market-oriented firms actively seek the benefits of a sustainability strategy such as image and reputation improvements, pioneer profits, decreased competitive pressure, and long-term value preservation (Li, 2014; Díaz-Garía, González Moreno, & Saez-Martinez, 2015). Finally, a 'technology push' can also spur the innovative behaviour of companies. This push can be caused by newly available technologies or improved technical knowledge (Rennings, 2000; Horbach, Rammer, & Rennings, 2012).

The relationship between sustainability and innovation can be described as reciprocal. On the one hand, the sustainability strategies of firms trigger innovations (Adams et al., 2016), while on the other hand, innovations are often (intentionally or unintentionally) responsible for improving the sustainability balance of a company (Carrillo-Hermosilla, del Río, & Könnölä, 2010). While some authors define eco or sustainability innovations (both terms are used interchangeably) as those that, next to the economy, benefit mainly the environment (Díaz-Garía et al., 2015; Carrillo-Hermosilla et al., 2010), others also include the social component in their definitions (Klewitz & Hansen, 2013; Boons et al., 2013). Eco or sustainability innovations are new products, processes, or services that improve the economic, environmental, and (depending on the definition) social balance of the adoptive institution, irrespective of whether the sustainability benefits were intended or not (Li, 2014; Hansen et al., 2009). This definition implies that any type of innovation (administrative, technical, marketing; incremental, radical) that fulfils the stated criteria can be considered an eco or sustainability innovation in principle.

When considering the impact of innovations on economic growth, it is important, as argued by Verspagen (2005), to distinguish between evolutionary and neoclassical perspectives. From an evolutionary perspective, the relationship between innovation and growth is contingent on other (e.g. historical) factors, while the neoclassical view is more deterministic in that it is assumed that growth can be predicted from changes in the production factors labour and capital, the capital/labour ratio, or externally induced technological progress, i.e. innovation (Hunt, 2011). The positive impact of innovations on economic growth can be explained with reference to the so-called quality ladder model. It implies that every innovation builds on previous innovations, thereby taking over the monopoly position of the old innovator and increasing the overall state, inducing a competitive 'race to the top' (Verspagen, 2005). Schumpeter (2003, p. 81) calls this a process of "creative destruction".

Empirical research confirms that innovations have positive economic effects. Pradhan, Arvin, Bahmani, and Bennett (2017) find bi-directional causality between innovation and economic growth in high-income OECD countries. Hasan and Tucci (2010) and LeBel (2008) confirm this finding for broad global country-

level samples. The impact of innovations on employment, however, is more ambivalent. While technological shifts and resulting process innovations can cause job losses in the short run, product innovations are generally considered to have a positive impact on employment (Pianta, 2005). An analogous relationship exists at the level of quality of employment: new technologies that make the execution of certain jobs easier can lead to a deskilling of workers, while complex technologies which demand higher intellectual skills can also increase the requirements of the resulting new jobs (Pianta, 2005). This ambivalence is confirmed by empirical research which also finds that the employment effect differs between industries (Bogliacino & Pianta, 2010).

On the corporate level, the strategic potential of eco or sustainability innovations to improve performance and competitiveness, as hypothesized by e.g. Porter and van der Linde (1995), Schaltegger and Synnestvedt (2002), and Cantwell (2005), is corroborated by empirical research. Li (2014) finds a positive influence of environmental innovation practices on the financial performance of Chinese firms, whereby the relationship is mediated by environmental performance. Eiadat, Kelly, Roche, and Eyadat (2008) find a positive relationship between environmental innovation strategy and business performance (sales growth, market share, and return on investment) of Jordanian chemical companies. Horbach et al. (2012) confirm that eco innovations lead to lower costs and higher turnover for German firms. Long, Chen, Du, Oh, Han, and Yan (2017), using a sample of Chinese firms, find that environmental innovations positively impact economic performance, represented by sales, market share, and profit. Eco or sustainability innovations were also shown to have a positive influence on employment. Cecere and Mazzanti (2017) find that successful green product and service innovations lead to the creation of new jobs in European SMEs. Kunapatarawong and Martínez-Ros (2016) and Horbach et al. (2012) find a positive relationship between eco innovation and employment in Spanish and German firms, respectively.

5.5. The Example of Sustainable Food in Tourism

Sustainable tourism strives for a balance between the satisfaction of economic, ecological, and social demands, and the aim of preserving the means of livelihood at a destination. As a central component of the touristic product, food plays an important role. Food production requires natural resources such as energy, water, and land, and causes CO₂ emissions responsible for climate change (Gössling & Hall, 2013). At the same time, food is also a commodity of twofold economic relevance. It is the major source of income for agricultural producers at the destinations, as well as a non-substitutable consumer good for travellers (Torres, 2003). Through food consumption, it is not only possible to increase the touristic experience while on holiday, but also to understand the ecological, social, and cultural resources of a destination.

Mass tourism as a special form of travel, and also package holidays as a special touristic product, possess several food-related particularities. For example, mass tourism and package holidays show a high degree

of standardization and commodification that also applies to food (Richards, 2002; Urry, 1990). This effect is enhanced by the tendency of many travellers to seek the comfort of the familiar on holidays instead of searching for authentic experiences (Richards, 2002; Urry, 1990; Wickens, 2002). Therefore, cultural experiences tend to be reduced through the mass consumption of food during package holidays. Food becomes a necessity rather than a luxury (Bourdieu, 2010). Within the touristic experience on a package holiday, food tends to be a more supportive element as opposed to its peak (Quan & Wang, 2004). At the same time, the resource-intensive nature of mass tourism and package tourism creates a higher potential to endanger the resources of a destination as a result of unsustainable food consumption compared to individual, distinctive tourism (Gössling, 2002).

The relationship between food and mass tourism can also be difficult from a cultural perspective. Cohen (1972, p. 169) regards mass tourism as “institutionalized forms of tourism” and distinguishes between organized and individual mass tourists. The organized mass tourist interacts only marginally with his/her environment. Instead, he/she is seeking a high level of familiarity while on holiday. The individual mass tourist leaves his/her “environmental bubble” from time to time, but his/her experience of novelty is mostly of a routine kind.

Research indicates that the general change in consumption towards sustainable food (Grebitus, Lusk, & Nayga Jr., 2013; Tully & Winer, 2014; Sellers, 2016; De Magistris & Gracia, 2016) is increasingly reflected in travellers’ behaviour. A grounding study about “Sustainable Food on Holidays” indeed shows that there is an increasing tourist demand for sustainable food based on an online survey (n = 7,915) (Lund-Durlacher, Fritz, & Antonschmidt, 2016). To stay attractive for these customer groups with a given willingness to pay, and to attract new customer segments that value sustainability even higher, it appears rational for hotels offering package holidays to make their food offerings more sustainable and to tailor their marketing strategies accordingly (López-Sánchez & Pulido-Fernández, 2016). Nonetheless, the adoption of sustainable food practices by hotels offering package deals remains low. Furthermore, if sustainable food options are offered, they are often not specifically marketed (Lund-Durlacher et al., 2016). Therefore, sustainable food constitutes an adequate example to investigate the reserved, seemingly irrational innovation behaviour of the hotel industry.

5.6. Sustainable Tourism, Hotel Industry, and Hotel Guests

Tourism's impact on destinations was initially considered to be predominantly positive, as the sector was representing an economic development engine for poorer nations (Nyaupane & Poudel, 2011). Especially its high labour intensity, the comparatively low capital and technology requirements, and the small-scale structure with low entry barriers for new market participants were considered as contributing to the tourism industry’s positive socioeconomic impact (Hall, Scott, & Gössling, 2013).

However, with the emergence of worldwide mass-scale tourism, the industry's potential to also negatively impact economy, society, and environment (Dimitriou, 2017), possibly exceeding the destinations' carrying capacity (Saarinen, 2006), has increasingly been recognized. Consequently, it has been argued that a new form of tourism would be needed. Based on traditional concepts such as nature-tourism, the social and economic spheres were additionally taken into account, giving rise to the notion of sustainable tourism (Hardy, Beeton, & Pearson, 2002).

However, while the definitional efforts in the area of sustainability and sustainable development are well-advanced, there is no single, agreed upon definition of sustainable tourism available to date. Some authors use sustainable tourism to refer to an attempt to balance the needs of tourists, the tourism industry, the local host community, and the natural resource base (Hardy et al., 2002; Bramwell & Lane, 1993; Butler, 1991). In contrast, Hunter (1997) argues that sustainable tourism should be seen as an adaptive paradigm, with the major aim of supporting sustainable development. Due to the diversity of prevailing conditions at the destinations, multiple strategies might be considered sustainable, spanning from tourism encouragement to tourism restriction. The balance of the three pillars of sustainability is thereby replaced by a flexible composition adapted to the local circumstances.

Critics of the concept of sustainable tourism such as Higgins-Desbiolles (2018) argue, however, that under industry and governmental pressure, sustainable tourism has developed towards an attempt to sustain 'traditional', growth-oriented forms of tourism with their accompanying negative externalities. She therefore calls for a widespread change in modern societies' consumption- and growth-driven culture which should then be reflected in less and better, i.e. ecologically and socially appreciative, tourism that serves higher, altruistic purposes.

A major requirement for most forms of tourism is the availability of accommodation, and in particular hotels. Hotels are the psychological base for tourists during their journey and the starting point for their activities at the destination, but they can also serve as attractions in and of themselves (Cooper, Fletcher, Gilbert, & Wanhill, 1993). Regarding the sectors' economic contribution, it is estimated that accommodation is responsible for about one third of all tourist expenditure (Cooper, Fletcher, Fyall, Gilbert, & Wanhill, 2005). Furthermore, the hotel industry is comparatively labour intensive, and serves as an entry opportunity for less qualified employment seekers (ILO, 2010).

Hotels play a critical role in sustainable tourism because they interact directly with the natural environment at a destination and are often built in environmentally sensitive areas (Singal, 2015). Their establishment and operation consume resources such as land, water, and energy, and produce emissions and waste (Melissen, Koens, Brinkman, & Smit, 2016; Bohdanowicz, 2005). From a broader socioeconomic perspec-

tive, hotels contribute indirectly to local income and employment via payments to local suppliers and service providers (Zeiss & Dürkop, 2014; Kim, Uysal, & Sirgy, 2013). The industry's image as an employer is, however, rather negative (Baum, 2015; Kusluvan, Kusluvan, Ilhan, & Buyruk, 2010), and its relationship to the local community can become ambiguous, with competition for labour and natural resources, overcrowding of destinations, and disrespect for the local culture recognisable as major negative impacts (Torres, 2003; dos Santos, Méxas, & Jasmim Meirino, 2017).

At the same time, the industry continuously attempts to improve its profitability through environmental measures on the operational level such as energy and water savings, and waste reduction (Stipanuk, 1996). The extent of implementation, however, varies considerably, mirroring the sector's known heterogeneity regarding other characteristics such as size of firm or profitability (Melissen, van Ginneken, & Wood, 2016). Furthermore, these 'traditional' environmental measures have not been considerably extended (Bruns-Smith, Choy, Chong, & Verma, 2015; Alonso-Almeida, Fernandez-Robin, Celemín Pedroche, & Santander Astorga, 2016). Consequently, the sociocultural engagement of hotels remains relatively underdeveloped (Melissen et al., 2016c), and their effort to make substantial changes to their human resource policies or to consider wider stakeholder claims is limited (Baum, 2015; Melissen, Cavagnaro, Damen, & Düweke, 2016).

From this characterisation, it can be concluded that hotels play a key role in the effective functioning of the tourism industry. At the same time, their efforts to adopt and implement new sustainability practices are limited to date, which means that the hotel sector can serve as an adequate reference case with important implications for the whole tourism industry. Referring to the categorisations of Dyllick and Muff (2016) and Adams et al. (2016), the hotel industry largely remains at the 'Sustainability 1.0' or 'Eco-Efficiency' stage.

Despite the mentioned indications that the tourist demand for sustainable food is growing, the adoption of sustainable food management practices by hotels offering package deals remains low (Lund-Durlacher et al., 2016). One reason for this reticence may be that the (real) attitude of guests is not necessarily considered to be pro-environmental by the hotel providers (Alonso-Almeida et al., 2016; Bohdanowicz, 2005; Melissen et al., 2016a). Furthermore, observational studies show that tourist behaviour does not necessarily change towards more sustainable practices in reality (Dolnicar, Knezevic Cvelbar, & Grün, 2017; Miao & Wei, 2013). Finally, the difficult identifiability of determinants of sustainable consumption choices might impede consistent marketing strategies for hotels (López-Sánchez & Pulido-Fernández, 2016).

6. RESEARCH QUESTIONS

As outlined in the prologue section, the age of globalization is accompanied by increasing variability, risk, and insecurity caused by a relative loss of nation states' power versus market actors. This trend has increased the responsibility of consumers and corporations to take into account the wider implications of their decisions for sustainability. Likewise, under the prevailing societal and political conditions consumers and corporations possess a significantly higher agency which they could, in principle, exercise for the achievement of sustainability goals. Although such an *ad hoc* market regime can only be an interim solution until international public regulatory bodies possess the necessary enforcement power over private actors to address global problems, it can still prove effective in tackling pressing sustainability issues (Held, 2002; Beck, 2009).

One rational strategy for corporations to take on more responsibility is to adopt and implement sustainability innovations which may constitute a competitive advantage and, at the same time, contribute to the improvement of the ecological and social performance of their businesses. An equivalent strategy for consumers is to act as citizen consumers; i.e., to express their sustainability orientation through their support for these sustainability innovations and the respective adjustment of their consumption behaviour.

Consequently, the central object of investigation in this dissertation is the disposition of hotels and consumers to adopt and implement sustainability innovations, taking the concept of sustainable food as a case example. The empirical observation of the real-life behaviour of tourists thereby serves as the analytical "action frame of reference" (Eldridge, 1980, p. 26).

The first study of the dissertation deals with the supply side and therefore clarifies what sustainable food is and if it is compatible with the prevailing business logic of mass holiday resorts, taking all-inclusive holidays as an example. The second and third studies analyse two important phases of the tourism value chain: The travel booking decision and the stay at the hotel. The second study tries to identify determinants of sustainable food travel product choices in order to improve the predictability of these choices. Finally, the third study evaluates the disposition of consumers to adapt their behaviour at the point-of-consumption.

The following research questions are addressed within the three empirical studies:

Study I:

- *RQ1: "What are the constituting elements of sustainable food as specified by definitions of the concept?"*

- *RQ2: “Can all-inclusive holidays in their current form be considered a sustainable product with respect to food?”*

Study II:

- *RQ: “Which attitudes, sociodemographic variables, product characteristics, and purchase behaviours are method-robust predictors of sustainable food travel product choices in a package holiday context?”*

Study III:

- *RQ 1: “Does the use of communication tools promoting ‘waste prevention’ to hotel guests reduce the amount of edible plate waste?”*
- *RQ 2: “Which of the communication tools promoting ‘waste prevention’ to influence guest behaviour are the most effective?”*

As a result of answering all research questions, it will be possible to conclude if and under which conditions an increased adoption and implementation of sustainability innovations such as sustainable food by the hotel industry appears possible.

7. EMPIRICAL STUDIES

The following section details the results of the three consecutive studies. While study one and three are equivalent to the respective manuscripts (to be) submitted to academic journals, study two is amended with an additional introduction to the applied methodology.

- *Study I: A Review of Definitions of Sustainable Food and their Implications for All-Inclusive Holidays (accepted for publication from Journal of Gastronomy and Tourism)*
- *Study II: Investigating the Determinants of Sustainable Food Travel Product Choices – A Methodological Comparison (Target Journal: tbd)*
- *Study III: Food Waste in Hotels - Can Direct Communication at the Point of Consumption Reduce the Attitude-Behaviour Gap? (Target Journal: Journal of Sustainable Tourism)*

7.1. Study I: A Review of Definitions of Sustainable Food and their Implications for All-Inclusive Holidays

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Abstract:

The question of food sustainability is an emerging field of interest and subject of increasing political debate. At the same time, food is one of the major pleasure components of the tourism product. This duality poses a challenge to tourism businesses to fulfil food sustainability requirements while remaining attractive to guests. Especially all-inclusive holidays are under increasing pressure since they are sometimes regarded as a particularly unsustainable travel product. Against this background, this study systematically analyses existing definitions of the sustainable food concept. A five pillar framework differentiating the dimensions 'Environment', 'Society', 'Individual/Health', 'Culture', and 'Economy' is applied, and the requirements along each dimension are compared to typical characteristics of all-inclusive holidays. The study finds that all-inclusive holidays, in their current form, cannot be considered sustainable with respect to food, mainly because their basic promises run contrary to the requirement of the sustainable food concept to minimize negative environmental and cultural impact. Furthermore, the cost-intensive overconsumption logic inherent in all-inclusive holidays puts the social and health balance under pressure. Nonetheless, the increasing guest segment that values sustainable food seems less price-sensitive than 'traditional' all-inclusive tourists, offering hotels some financial space to implement a change towards sustainability. A reduction in environmental impact, however, appears only possible by allowing less, but higher-quality all-inclusive tourism.

Keywords: sustainable food, all-inclusive holidays, mass tourism, sustainable tourism, hotel industry

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Introduction

In a world whose population is expected to grow to over 9 billion people by 2050 (Gössling & Hall, 2013), it is safe to predict a rising demand for food. This is likely to increase the level of greenhouse-gas emissions caused by food production, which play a crucial role in climate change (Gössling, 2002). Furthermore, the health implications of food consumption are a major concern, especially in modern societies where, meanwhile, 1.5 billion people are either overweight or obese (FAO, 2012). Finally, the process of globalization causes rapid socio-cultural changes in many countries which are accompanied by questions regarding the protection of cultures and traditions: one component of which is food (Padilla, Capone, & Palma, 2012). Against this background, the question of food sustainability is an emerging field of interest and subject of increasing political debate.

Food is also central to the tourism product, and is categorized by McKercher (2016) as one of the major pleasure components of a trip. Consequently, food accounts for one third of tourist spending (Torres, 2003), and the quality and variety of the food offer is considered a top criterion influencing destination choice (Koc, 2013). This duality poses a challenge to tourism businesses to fulfil food sustainability requirements while at the same time remaining attractive to guests. Especially all-inclusive holidays are under increasing pressure since they are sometimes regarded as a particularly unsustainable travel product (Woosnam & Erul, 2016; Alegre & Pou, 2008; Aguiló & Rossello, 2012; Farmaki, Georgiou, & Christou, 2017).

All-inclusive holidays are a special form of package holidays whereby tourists pay in advance for a package consisting of transport, accommodation, food, entertainment, and other holiday activities. Hotels which offer all-inclusive packages are often organized as resorts which, next to accommodation and dining facilities, also include leisure facilities, shops, and night time entertainment (Alegre & Pou, 2008). From a sustainability point of view, however, all-inclusive packages are regarded as problematic. Common issues include leakage of tourist spending, an overconsumption tendency regarding resources such as food and water, limited interaction between tourists and the destination's inhabitants and their culture, cannibalization of the local tourism economy such as shops or restaurants, and adverse working conditions for the service staff resulting from the around-the-clock service concept embraced by tourism resorts (Woosnam & Erul, 2016; Alegre & Pou, 2008; Aguiló & Rossello, 2012; Farmaki et al., 2017).

Despite the frequent accusation of unsustainability, a systematic evaluation of all-inclusive holidays with respect to food sustainability is still lacking. One reason is that it is not yet clear which concrete requirements the concept of sustainable food actually implies. This article addresses this research gap by breaking down definitions of the sustainable food concept into their constituent elements based on the five-pillar approach to sustainable food of von Koerber (2010). Afterwards, the requirements of the concept are

compared to typical characteristics of all-inclusive holidays. The aim of the article is to summarize the requirements of the sustainable food concept and to arrive at an unambiguous conclusion on the sustainability of all-inclusive holidays with respect to food. From this conclusion, specific managerial implications for the tourism industry offering all-inclusive holidays will be derived.

Sustainability Issues of Food and Tourism

Food production requires natural resources such as energy, water, and land, and causes CO₂ emissions responsible for climate change (Gössling & Hall, 2013; Gössling, Garrod, Aall, Hille, & Peeters, 2011). So-called higher-order foods – foods such as e.g. beef or lamb whose production requires a high amount of energy – contribute especially high CO₂ emissions. The disproportionately high consumption of higher-order foods during holidays is also seen to have major implications for water use (Gössling, Peeters, Scott, Hall, & Lehmann, 2012).

At the same time, food is also a commodity of twofold economic relevance: it is the major source of income for agricultural suppliers in many destinations and a non-substitutable consumer good for travellers (Torres, 2003). Through food consumption, tourists have the possibility to not only augment their hedonic experience, but also to come to understand the destination's ecological, social and cultural resources. Therefore, food is considered an important element for the choice of a holiday destination (Koc, 2013).

Food can also be considered as part of a destination's cultural heritage. Mak, Lumbers, and Eves (2012) discuss food as a dimension of travel and give an overview of the functions food can have on holiday: ranging from a pure physiological necessity to an integral part of the place's cultural capital. In differentiating the various motivations to consume food on holidays, these authors find a symbolic motive that refers to the exploration of local cultures. Kim, Eves, and Scarles (2009) similarly find the desire to increase one's own knowledge of a destination and having an authentic experience as cultural motives to consume local food.

Especially on holiday, where food consumption mostly happens in public places, the societal dimension of food comes to the fore. It is characterized by a strong relationship between food and personal identity (Richards, 2002) since food preparation and consumption can be an expression of human culture and can serve as an instrument of social distinction (Bourdieu, 2010).

From an economic perspective, it is recognized that food is responsible for a substantial amount of tourist spending. Torres (2003) estimates the share as some one-third of all expenditures. Through backward linkages, purchasing of local food can have a substantial indirect impact on the local economy leading to income and employment (Zeiss & Dürkop, 2014). Another effect can be the diversification of rural economies

(Richards, 2012). At the same time, the use of food imports can harm local agriculture and considerably reduce tourism's economic benefits (Richards, 2002).

Food also influences the tourism sector's relation to the local community. Gössling (2002) highlights the competition for land that is needed to produce food for the hospitality sector. Furthermore, water to produce these foods can lead to scarcities in drought-prone regions. Competition for labour, as highlighted by Torres (2003), can also have negative effects on local agricultural production and potentially place upward pressure on local food prices.

Finally, food and nutrition can impact the health and well-being of consumers: either positively or negatively. There are differences between tourist groups in terms of risk disposition, with recreational tourists being rather cautious with respect to food and experiential tourists being rather more open-minded (Cohen & Avieli, 2004). At the same time, food is welcomed as a source of health by travelers. Kim et al. (2009) find that the assumed positive impact on health can be one motivational factor to consume local food on trips and holidays.

Consumers' Willingness to Pay

A review of general consumer literature indicates an increased willingness to pay for sustainable food options. Grebitus, Lusk, and Nayga (2013) find that consumers are willing to pay more for local food, especially when local food is associated with beneficial qualities such as freshness, taste, and safety, or is believed to support the local economy. Tully and Winer (2014) conducted a meta-analysis on papers investigating the willingness to pay for socially responsible products including food. They find a general willingness to pay for responsible products which is even higher for products that demonstrate social responsibility such as good labour practices and fair trade. Sellers (2016) investigated Spanish consumers' willingness to pay a price premium for sustainable wine (sustainability dimension not further specified) using a consumer survey. He finds that a great majority of consumers (77.9%) is willing to pay an average premium of 12.9% for sustainable wine; consumer knowledge levels about sustainable products are found to have a positive influence on this willingness to pay. De Magistris and Gracia (2016), taking almonds as an example, tested the willingness to pay for products with a label of origin. They find a higher willingness to pay for products with a local label (distance less than 100km) in comparison to unlabelled products. If the label, however, indicates the food to come from great distances (800/2,000km), the willingness to pay decreases to a lower level than for unlabelled products.

All-inclusive Holidays

The origins of all-inclusive holidays date back to the 1930s when the concept was first introduced in holiday camps in Britain as a cheap alternative for working-class families (Farmaki et al., 2017). Today, the most

popular all-inclusive destinations are the Caribbean and the Mediterranean area (Anderson, Juaneda, & Sastre, 2009). The main target market is European travellers and in particular middle income families (Alegre & Pou, 2008).

Anderson et al. (2009) and Alegre and Pou (2008) differentiate three main motivational factors to go on all-inclusive holidays, namely convenience and relaxation (e.g. prearrangement of the trip, flexible hotel timetables), safety and security (e.g. safety at the destination, harmlessness of meals), and economy of resources (e.g. value for money, calculability, opportunity to use many facilities in a short amount of time). Among the different components, Tavares and Kozak (2015) find that food is considered the most important item when purchasing an all-inclusive package, followed by entertainment, tour, transfers, and beverages. The authors, however, do not specify which food qualities guests prefer while on all-inclusive holidays.

Anderson et al. (2009), surveying travellers to Mallorca, find a high satisfaction with all-inclusive holidays reflected in a high intention to revisit the island within such an arrangement. Anderson (2007) finds that more than 20 percent of travellers to Mallorca would not have visited the destination if there was no all-inclusive offer. It follows that these products constitute an important attraction for holiday destinations and make important contributions to tourism income. Nonetheless, all-inclusive holidays is a form of travel with limited extra spending potential in the destination compared to other forms of holidays. Additionally, most of this extra spending happens within the accommodation so that it is transferred to the mostly foreign-owned travel operator (Aguiló & Rossello, 2012; Alegre & Pou, 2008; Anderson, 2007).

There is ambiguous evidence on the social performance of all-inclusive holidays. While all-inclusive resorts create skilled employment in the destinations, their labour demand is lower compared to other arrangements through the economies of scale that these offers realize (Tavares & Kozak, 2015). Furthermore, the working conditions in the resorts are often not favourable compared to other forms of travel. In particular, the employees have to be present for long, irregular hours to provide around-the-clock service (Farmaki et al., 2017; Aguiló & Rossello, 2012). Due to their concentrated demand for service personnel, all-inclusive resorts also have a higher potential to disrupt local labour markets compared to other, more dispersed facilities (Torres, 2003).

Furthermore, despite their popularity and economic contribution, the status of food within all-inclusive holidays is comparatively low. All-inclusive holidays are mass tourism products and a special form of organized package holidays and as such possess several food-related particularities. For example, these holidays are often highly standardized and occur in large-scale settings, characteristics which are also reflected in their food offer (Richards, 2002; Urry, 1990). Gössling (2002) concludes that the resource-intensive nature of food consumption during organized package holidays entails a higher potential to endanger

the environmental resources of a destination than food consumption within individual, distinctive holidays.

Also from a socio-cultural perspective, all-inclusive holidays show unsustainable tendencies. Cohen (1972), referring to mass tourism in general, characterizes it as “institutionalized forms of tourism” (p. 169) and distinguishes between organized and individual mass tourists. The organized mass tourist interacts only marginally with the environment, and instead seeks a high level of familiarity while on holiday. Despite leaving their own “environmental bubble” (p. 168) from time to time, the individual mass tourist has only a routinized experience of novelty. Accordingly, in such a mass consumption context, food becomes rather a necessity than a luxury (Bourdieu, 2010), more a supportive element than a peak (Quan & Wang, 2004). Summarizing, the tendency of many travellers to seek the comfort of the familiar on organized package holidays impedes the achievement of authentic experiences (Richards, 2002; Urry, 1990; Wickens, 2002) and lowers the cultural experience of tourists (Lund-Durlacher, Fritz, & Antonschmidt, 2016).

In conclusion, the prerequisites for all-inclusive holidays to be considered sustainable with respect to food are unfavourable. However, each of the reviewed studies so far discussed only one particular sustainability dimension, and most of the studies did not focus on the aspect of food. Furthermore, some of the analyses were conducted at the level of mass tourism and package holidays in general, so that it is not apparent where the specific problems of all-inclusive holidays with respect to food sustainability lie, or how these could potentially be overcome.

The Purpose of the Study and Methodology

Considering the lack of a comprehensive overview of the requirements of the concept of sustainable food and the consequential lack of a systematic evaluation of all-inclusive holidays with respect to food sustainability, the following research questions are formulated to address these shortcomings:

RQ1: *“What are the constituting elements of sustainable food as specified by definitions of the concept?”*

RQ2: *“Can all-inclusive holidays in their current form be considered a sustainable product with respect to food?”*

To answer these research questions, this study uses a qualitative approach. To attain the existing definitions of sustainable food, a systematic narrative literature review was conducted. A systematic narrative review “aims to comprehensively identify all relevant studies to answer a particular question” (Petticrew & Roberts, 2006, p.39) which are then extracted, checked and narratively summarized (Petticrew & Roberts, 2006). While various definitions of sustainable food already exist, there is yet to emerge a societal or academic consensus on what the term precisely means, what elements are most fundamental, and where

the boundaries are demarcated. Consequently, conducting a systematic narrative review to assemble and analyse extant knowledge and perspectives is a reasonable and valid approach. Furthermore, a comparison of the concept of sustainable food to the characteristics of all-inclusive holidays as they are practiced by the travel industry at present has not been conducted so far.

This method was chosen because it captures the diverse public discourse surrounding the concept (in German and English speaking countries) with a transparency of process that enables the mitigation of potential selection bias to a greater extent than methods such as expert interviews, the Delphi technique, or focus groups. Furthermore, sources from different time points can be analysed.

As sources for the review, 126 pieces of academic literature (journal articles and book chapters) and 'grey literature' (reports of public sector bodies and practical guidelines) discussing sustainability aspects of food were analysed. An attempt was made to collect all material available through searches of stems and combinations of keywords like 'food', 'diet', 'consumption', 'eating', 'responsibility' and 'sustainability' using the search engine 'Google' and the scientific database 'Science Direct'. Further sources were identified from the bibliographies of the initial literature in a 'snowballing procedure'. The material was searched for an explicit, manifest definition of 'sustainable food'. The final sample consisted of 19 definitions since all other sources lacked an explicit, manifest definition. Although there was no time restriction imposed on the initial search, the time range of the definitions is 2004 to 2019, indicating that sustainable food is a relatively recent phenomenon.

Insert Tab. 7.1.1

Afterwards, a directed content analysis of the definitions was conducted (Hsieh & Shannon, 2005). This type of analysis "is recommended when the purpose of the study is to test a theory" (Moldavska & Welo, 2017, p. 745). It uses categories derived from an existing theoretical framework to code the material accordingly. Depending on the results, support for the initial theoretical framework can be found (Hsieh & Shannon, 2005).

A theoretical framework is provided by von Koerber (2010) who inductively develops meta-categories from an analysis of recent worldwide developments related to food such as climate change, obesity, or income disparities. Based on this analysis, von Koerber distinguishes the meta-categories 'Individual/Health', 'Society', 'Economy', 'Environment', and 'Culture'. Following, the texts of the definitions were coded using this five-pillar concept of sustainable food. The results of the coding therefore also give an indication if von Koerber's concept is able to capture the breadth of the definitions.

In the first instance, the definitions of sustainable food were extracted from the sample studies. The analysis focused only on the manifest content, i.e. no interpretation of the meaning of the text was undertaken

(Moldavska & Welo, 2017). The coding of the material was done manually to avoid misspecifications frequently arising in computer assisted coding.

Results of the Systematic Narrative Review

Insert Tab. 7.1.2

In order to answer the research questions, the definitions were systematically analysed focusing on the respective sustainability dimension. In addition, the results were contextualized with reference to literature specific to all-inclusive holidays. Where appropriate, links were drawn to wider socio-economic theory. The content of the definitions is reviewed below. After the content analysis, the number of definitions that included certain dimensions was ascertained to serve as a first indicator for the importance of each dimension.

The following section provides a systematic narrative review of the analysed definitions. The focus of the review was on the concrete requirements that the definitions specify. The review is structured along the meta-categories of von Koerber (2010). Following the review, the requirements were compared to the characteristics of all-inclusive holidays.

Insert Tab. 7.1.3

Environment

Insert Tab. 7.1.4

One major requirement for sustainable food is to be protective of environmental resources. Consequently, sustainable food must have only a minimal impact on the environment (e.g. American Public Health Association, 2007; Burlingame, 2011). This means “maintaining healthy ecosystems” (American Public Health Association, 2007, Overview of the US Food System section, para. 4), while causing as “low environmental impacts” (Burlingame 2011, p. 7) as possible. A concrete requirement is to produce food without synthetic fertilizers and chemical pesticides (Sidali, Spiller, & von Meyer-Höfer, 2016). Related to resource protection are the preservation of biodiversity and the resilience of the food providing system. Accordingly, sustainable food is “protective and respectful of biodiversity” (Burlingame 2011, p. 7), prevents “the irreversible loss of natural resources” (Freibauer, Mathijs, Brunori, Damianova, Faroult, Girona i Gomis, O’Brien, & Treyer, 2011, p. 128), and protects “the stock of natural capital and ecosystem service” (Gössling & Hall, 2013, p. 12).

This highlights that the definitions follow the so-called ‘strong sustainability approach’. This view regards the different sustainability spheres as complementary and interconnected, with a stable ecology being the

foundation on which societies, and then economies, are built (Daly & Cobb, 1994). Some of the definitions can be described as taking an eco-centric viewpoint in attaching intrinsic value to nature, and placing human and environmental spheres in a reciprocal, equal relationship (Baker, 2006). More anthropocentric considerations are evident in the definitions highlighting the role of ecosystem services and referring to natural elements as ‘resources’.

Only few of the definitions further specify the qualities that sustainable food must possess to contribute to resource protection. These qualities are seasonality of the food offered (Department for Environment, Food and Rural Affairs, 2011; Padilla, Capone, & Palma, 2012), organic production (Pack, Friedl, Lorek, Jäger, Omann, & Stocker, 2005; von Koerber, 2010), and vegetable food (The Sustainable Restaurant Association, 2015; von Koerber, 2010). Also environmental ethics plays an important role, as sustainable food must be protective of animal welfare (Öko-Institut e.V. und Institut für sozial-ökologische Forschung, 2007; The Sustainable Restaurant Association, 2015).

In the tourism context, the need for environmental protection is augmented by the consideration of nature as a valuable asset that motivates tourists to visit a destination. A strong sustainability approach coincides with this requirement. Furthermore, the natural setting in which tourism takes place is often particularly sensitive to external influences (Urry, 1995; Singal, 2015). This applies even more to all-inclusive holidays which frequently take place in exotic destinations. In fact, all-inclusive resorts encourage tourists to visit exotic destinations for the first time since they offer the desired security to explore the unknown terrain. In this way, all-inclusive resorts encourage the anthropogenic exploitation of sensitive landscapes (Anderson et al., 2009) which increases the chances of biodiversity loss and interruptions of the ecological systems crucial for food production. Further running contrary to environmental food sustainability endeavours, all-inclusive holidays are characterized by a tendency to overconsume food, which stems from the logic of paying-in-advance for the possibility of unrestricted consumption at the destination. Finally, the resort structure with its many large-scale facilities in immediate vicinity leads to a concentration of environmental pollution (Farmaki et al., 2017).

Society

Insert Tab. 7.1.5

A multitude of aspects can be subsumed under the societal dimension. These can be broadly separated into consumer-focused and producer-focused aspects. First, the consumer must be granted fair and secured access to food which is suitable for daily use. Consequently, the definitions stress the need for “accessible food to all” (Tendall, Joerin, Kopainsky, Edwards, Shreck, Le, Kruetli, Grant, & Six (2015), p. 19) that “should be affordable for all people” (Ministerium für Umwelt, Landwirtschaft, Ernährung, Weinbau

und Forsten Rheinland-Pfalz, 2015, p. 6) and “adequate for daily routines” of consumers (Hayn, Empacher, & Halbes, 2005, p. 3).

On the part of the food producers, good working conditions must be provided (e.g. American Public Health Association, 2007; Sustain: The alliance for better food and farming, 2013), and the livelihood of producers must be permanently secured (e.g. Sustainable Development Commission, 2011) implying that sustainable food “is sold at a fair price for the producer” (Azzurra, Massimiliano, & Angela, 2019). In this way, sustainable food is to “contribute to thriving local economies” (Sustain: The alliance for better food and farming, 2013, p. 1), provide “decently rewarded employment along the supply chain” (Sustainable Development Commission, 2011, p. 13), and ensure “fair trading relations” (Öko-Institut e.V. und Institut für sozial-ökologische Forschung, 2007, p. 6).

A third aspect concerns intergenerational relationships, i.e. a responsibility for both consumers and producers to keep the food system intact for future generations (e.g. Burlingame, 2011). Here, the requirements are broad and comprise general principles of fairness, justice, or equality (e.g. Sustainable Development Commission, 2011; The Sustainable Restaurant Association, 2015).

While affordability and accessibility of food are usually secured for the tourists, especially with inexpensive all-inclusive holidays, the safeguarding of adequate working conditions along the supply chain is a challenge for tour operators offering all-inclusive holiday packages in particular, since this form of tourism takes place in a variety of socio-economic contexts (Baum, 2015). While all-inclusive resorts create employment in the destinations along the food production chain (e.g. for farm workers, kitchen staff, and waiters), they often offer only seasonal employment with long, irregular working hours, while the potential for additional earnings for the hotel staff through increased sales is limited (Farmaki et al., 2017; Aguiló & Rossello, 2012). A further social issue can arise from the competition for land, water, and labour, since it can impact local agricultural production with potentially negative consequences for affordability and accessibility of food for the local population (Gössling, 2002; Torres, 2003).

Individual/Health

Insert 7.1.6

The health requirements of sustainable food can be classified according to the concept of the hierarchy of needs (Maslow, 1943). They start with the basic requirement to provide sufficient food and food that is safe for the consumer to eat (e.g. Aiking & de Boer, 2004; Tendall et al., 2015). Furthermore, sustainable food “contribute[s] to human health” (Sustainable Development Commission, 2011, p. 13) and is a “healthy balanced diet” (Department for Environment, Food and Rural Affairs, 2011, p. 8) of “nutritionally dense product” (Padilla et al., 2012, p. 232).

Less often mentioned is the aspect of food safety, with sustainable food “preventing food-borne diseases” (Sustainable Development Commission, 2011, p. 13). Health here is negatively defined as the absence of illness. Finally, there is a hedonic component, so that sustainable food “contributes to the physical, mental and social well-being” (Öko-Institut e.V. und Institut für sozial-ökologische Forschung, 2007, p. 6) of its consumers. It is, however, not specified further which concrete qualities of sustainable food this implies.

In the context of all-inclusive holidays, the health requirements of travellers differ widely. While consumers of inexpensive organized package, all-inclusive offers may simply look for safe, filling food (Koc, 2013; Koc, 2016), other, more financially potent customers, may strive to increase their hedonic holiday experiences or to improve their physical health through special dietary holiday offers (Kim et al., 2009). On the supply side, however, competitive pressures frequently lead all-inclusive tourism resorts to offer inexpensive, low quality, and unhealthy food (Koc, 2013; Koc, 2016).

Culture

Insert 7.1.7

Compared to the other dimensions, culture is less prominent in the definitions, and only half of them contain a cultural aspect. Culturally sustainable food is of “local production” (American Public Health Association, 2007, Overview of the US Food System section, para. 4), is to “safeguard food traditions and culture” (Padilla et al., 2012, p. 232), shows “appreciation and support for the primary production sector” (Vermeir & Verbeke, 2008, p.542), and keeps the “connection to the region” (Ministerium für Umwelt, Landwirtschaft, Ernährung, Weinbau und Forsten Rheinland-Pfalz, 2015, p. 9).

At the same time, some definitions also promote cultural diversity and the freedom to consume food that the individual consumer considers appropriate with requirements such as “diversity of consumption habits and practices” (Öko-Institut e.V. und Institut für sozial-ökologische Forschung, 2007, p. 6). Rarely mentioned is the requirement for food to be “culturally acceptable” (Burlingame, p. 7), i.e. to respect the conventions of the place where the food is offered.

This discrepancy reflects the variety of roles food can have for the cultural experience on all-inclusive holidays. On the one hand, organized package tourists’ preference for familiarity, as hypothesized by Cohen (1972), motivates them to maintain their known consumption habits and practices. This potentially conflicts with the local food culture in the destinations (Méxas & Jasmim Meirino, 2017; Urry, 1990). On the other hand, some tourist segments proactively seek to interact with the cultural resources of a destination through the consumption of authentic local food (Mak et al., 2012b; Kim et al., 2009). Likewise, while some segments of all-inclusive travellers are willing to experience local food (Wong & Kwong, 2004), they are at the same time dependent on the travel operator to offer such food (Farmaki et al., 2017). Especially the

local restaurant culture is threatened by this tendency of all-inclusive travellers to consume food nearly exclusively within the resort (Alegre & Pou, 2008).

Economy

Insert Tab. 7.1.8

Economic considerations play only a minor role within the definitions. Only 5 of 19 definitions mention an economic aspect. Those definitions that take the economic pillar into account focus on the requirement to create food systems which are as resource-efficient as possible and which use the resources where their impact is greatest (e.g. Freibauer et al., 2011; Pack et al., 2005). Requirements are to “optimize food output” (Gössling & Hall, 2013, p. 12) through “higher resource efficiency” (Pack et al. 2005, p. 6). Another aspect is the preference for fair trade products (e.g. von Koerber, 2010), whereby this product quality is not specified further. It therefore remains unclear if it refers e.g. to the conditions of the fair trade certification scheme (Fairtrade Labelling Organizations International, e.V., 2018). One definition even claims “shifting from an approach in terms of productivity to an approach in terms of sufficiency” (Freibauer et al., 2011, p. 128). While the definitions take single economic aspects into consideration, they do not evaluate the economic sustainability of the concept on a broad, aggregate base. Consequently, there is no consideration of the potential economic costs and benefits related to the concept.

Contextualizing the economic requirements, resource efficiency is a challenge for resorts reverting to all-inclusive holidays. This is highlighted by the tendency of resort hotels to offer unreasonably large quantities of food, much of which goes to waste. Further exacerbating the problem, tourists show an overconsumption rather than a sufficiency tendency while on all-inclusive holidays (Koc, 2013; Koc, 2016). Lessening this effect, however, is the attempt of providers to save costs by limiting the amount of food consumed, e.g. through a decrease in service level (Aguiló & Rossello, 2012). Finally, labour productivity along the food production chain is comparatively low, and a high share of food is lost already before reaching the all-inclusive resorts (Ministerium für Umwelt, Landwirtschaft, Ernährung, Weinbau und Forsten Rheinland-Pfalz, 2015).

Discussion

From this review of the definitions, it can be concluded that the elements of sustainable food can be exhaustively captured along the five dimensions von Koerber (2010). At the same time, the assumption of a balance between the sustainability dimensions, as assumed by von Koerber and argued for by sustainability theorists (Atkinson, Dietz, & Neumayer, 2007; Robertson, 2014; Baker, 2006), does not stand the empirical test. Rather, there is a clear tendency for environmental, social, and individual/health-related aspects to dominate the discourse.

If at all, the definitions show only very few explicit ties to broader sustainability theories. In addition, they are derived without reference to particular research methods. This highlights that sustainable food so far is rather a societal than an academic phenomenon. Furthermore, a high homogeneity within the dimensions was found, and only the cultural dimension shows some divergence in accentuation between safeguarding of local food traditions and promotion of diversity in consumption habits. A further finding is that the definitions implicitly favour a strong sustainability view, potentially increasing the challenge to implement the concept. Pointing in the same direction, within the definitions there is no explicit consideration of the interactions between the single meta-categories and their possible relationship. Some requirements might indeed be difficult to achieve simultaneously, e.g. to provide sufficient quantities of affordable food while at the same time minimizing resource use and producing organically. In this respect, it is also noteworthy that only a minority of definitions provide concrete recommendations on the qualities of the food to be offered.

The context of all-inclusive holidays tends to intensify these sustainability issues and increases the challenge of meeting the requirements of the concept. In contrast to the general definitions, it furthermore places significant emphasis on cultural and economic aspects. Especially the cultural motive as a significant determinant for the consumption of local food in the destination is not sufficiently attended to by providers of all-inclusive holidays. In fact, organized package, all-inclusive offers tend to feature international dishes which can be a potential threat to local food cultures. Furthermore, although its effect is attenuated by cost restrictions, the resource intensity of these offers has the potential to negatively impact the destinations' local markets for food and labour.

Conclusions and Perspectives

This research has shown that food plays a crucial role for the sustainability balance of all-inclusive holidays. The concept of sustainable food thereby addresses several of the tourism industry's known sustainability issues such as the protection of valuable natural resources in the destination, the safeguarding of adequate working conditions along the supply chain, and respect for local cultures.

From the comparison of the concept's concrete requirements to typical characteristics of all-inclusive holidays, it can be concluded that this product type, in its current form, cannot be considered sustainable. The main issues lie in the environmental and cultural impact of all-inclusive holidays. Here, the basic promises of all-inclusive resorts to be located as close to natural attractions as possible and to offer standardized, international food run contrary to the requirement of the sustainable food concept to minimize environmental and cultural disruption.

Along the other dimensions, the result is more balanced. On the one hand, the economic requirement of resource efficiency is compatible with the budget restrictions that providers of all-inclusive holidays are subject to. Furthermore, the guests' demand for harmless food supports the requirement of sustainable food to be safe for the consumer. On the other hand, all resources offered directly to the guests need to be provided without restriction. This is not only a threat to attempts for overall resource efficiency, but also puts the social and nutritional health balance under pressure as the hotel staff faces long, irregular working hours, and the choice of the food to be offered becomes dominated by cost considerations.

Especially resort hotels that offer inexpensive all-inclusive holidays will be challenged by the concept since their possibilities to change towards a more sustainable offer are limited by financial restrictions (Aguiló & Rossello, 2012; Farmaki et al., 2017; Lund-Durlacher et al., 2016). However, the review of current studies analysing consumer behaviour also showed that demand has already partly shifted towards more sustainable food practices and that there is generally a willingness to pay for more sustainable options (Greibitus et al., 2013; Tully & Winer, 2014; Sellers, 2016; De Magistris & Gracia, 2016). From the range of definitions of multiple sources, it can furthermore be concluded that there exists considerable and increasing political support to implement more sustainable practices.

One major implication for hotels is therefore to change or even to abandon the 'traditional' all-inclusive offer in order to react to the increasing demand for more sustainable tourism products and to broaden the customer base with the aim to attract also the important sustainability-conscious guest segments. These guest segments seem less price-sensitive than 'traditional' all-inclusive tourists, offering hotels some financial space to implement the change.

The gained financial resources could then be reinvested to improve the sustainability balance of the food offer in the resorts. In the long run, the resorts furthermore could open up to the local community to improve their cultural anchoring. One concrete recommendation in this respect is to offer dine around plans for local restaurants to the guests. Examples show that these arrangements are already successfully implemented in popular holiday destinations, e.g. in the Caribbean. To compensate for environmental degradation, resorts could be encouraged to fund local conservation initiatives. Again, positive examples already prove that such measures are feasible. A reduction in environmental impact, however, appears only possible by allowing less, but higher-quality all-inclusive tourism. Higher prices could be the appropriate means to achieve this end. In either case, hotels should proactively communicate the measures they take to ensure the guests understand and therefore value the changes.

Several limitations of the study should be noted. Due to the small number of studies analysed, quantitative assessments can only give a rough indication of the relative importance of their content. Furthermore, the literature considered were all in English or German since these are the languages the author is familiar

with. It is likely that further sources in other languages exist. However, it is assumed that especially the inclusion of English sources ensures that the major works on the topic have been covered. Furthermore, it is possible that not all 'grey literature' (e.g. proceedings, policy reports, dissertations) has been reviewed. However, it should be justifiable to only include the most widespread and accessible literature since this is likely to have the greatest influence on the public discourse.

Future empirical research may be needed to find out if and how the implementation of the concept of sustainable food by the industry proceeds. Especially the consumer acceptance of a more sustainable food offer in the organized package, all-inclusive holiday context, and the drivers and barriers for its implementation on the part of the hotel industry are potentially fruitful future research areas.

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Biographical Note

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Tables

TAB. 7.1.1: SOURCES OF THE ANALYZED DEFINITIONS

Type of Source	No.
Journal Article	6
Online Article	1
Research/Policy Report	10
Chapter in Edited Book	1
Practical Guideline	1
Sum (N)	19

TAB. 7.1.2: DEFINITIONS OF SUSTAINABLE FOOD

Source	Country (Institutional Affiliation of Author(s))	Type	Original Definition
Aiking & de Boer (2004)	Netherlands	Journal Article	p.361: “[There are] diverging interpretations of food sustainability, with food security, food safety, and governance as the three key themes.”
American Public Health Association (2007)	USA	Online Article	“APHA defines a sustainable food system as one that provides healthy food to meet current food needs while maintaining healthy ecosystems that can also provide food for generations to come with minimal negative impact to the environment. A sustainable food system also encourages local production and distribution infrastructures and makes nutritious food available, accessible, and affordable to all. Further, it is humane and just, protecting farmers and other workers, consumers, and communities.”
Azzurra, A., Massimiliano, A., & Angela, M. (2019)	Italy	Journal Article	p.105: “Index of consumers’ food sustainability concerns FSCI: Attributes in general food choices, the product <ol style="list-style-type: none"> 1. Is obtained in an environmentally friendly way 2. Is produced in a way that respects biodiversity 3. Is grown using sustainable agriculture practices 4. Is produced respecting animal welfare 5. Is produced without the use of pesticides 6. Is produced with low carbon emissions 7. Is produced in an unspoilt environment 8. Is produced reducing the amount of food waste 9. Is packaged in an environmentally friendly way 10. Is locally produced to support local farmers 11. Is produced in respect of human rights 12. Is sold at a fair price for the producer 13. Keeps me healthy”
Burlingame (2011)	Italy	Report	p.7: “Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future gen-

			erations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.”
Department for Environment, Food and Rural Affairs (2011)	UK	Report	p.8: “Six themes [...] cover the full range of issues related to sustainable food: animal welfare, British seasonal production, ethical production, healthy balanced diet, sustainably sourced fish and environmental sustainability.”
Freibauer, Mathijs, Brunori, Damianova, Faroult, Girona i Gomis, O’Brien, & Treyer (2011)	Belgium	Report	<p>p.128: “1. Well-being: food and agricultural systems should serve the well-being and quality of life of all stakeholders involved: farmers and agribusiness should earn a sufficient income producing secure, safe and healthy food for consumers as well as public goods (environmental services); fair access by all to a healthy food is critical for food security and well-being.</p> <p>2. Resource use efficiency and optimality: given the increasing scarcities in vital resources, resources should be used as efficiently as possible (by avoiding waste, recycling and reducing our footprint), but they should also be used optimally, that is, where their contribution is greatest (by applying the cascading principle of resource contribution); [...] shifting from an approach in terms of productivity to an approach in terms of sufficiency.</p> <p>3. Resource conservation: [...] critical natural resources, including biodiversity, land and water should be maintained.</p> <p>4. Diversity and inclusion: food and agricultural systems should reflect the territorial diversity present within the EU and worldwide; diversity may be instrumental for the resilience of our systems, but should also enhance the equitable access to affordable and healthy food and to natural resources.</p> <p>5. Transdisciplinarity: research and innovation underpinning future food and agricultural systems should be truly interdisciplinary, [...] but be also transdisciplinary, that is, fully integrating the end user into research and innovation.</p> <p>6. Experimentation: in order to develop the key breakthroughs needed to address the Grand Challenges of our time, research should be diverse, [...] Transdisciplinary research should have sufficient room for experimentation.</p> <p>7. Coordination and impact evaluation: research should be better coordinated across thematic domains as well as Member States. At the same time research impacts should be better monitored and evaluated.</p>

			8. Public involvement: strong public investment in research remains crucial to safeguard all previous principles.”
Gössling & Hall (2013)	Sweden/New Zealand	Book Chapter	p.12: “A sustainable culinary system must be able to demonstrate that it can optimize food output and consumption without compromising the stock of natural capital and ecosystem service.”
Hayn, Empacher, & Halbes (2005)	Germany	Report	p.3: “Sustainable food [...] means an environmentally friendly and constitutional diet that is adequate for daily routines and socio-culturally diverse.”
Ministerium für Umwelt, Landwirtschaft, Ernährung, Weinbau und Forsten Rheinland-Pfalz (2015)	Germany	Report	p.4: “Sustainable food positively impacts five different dimensions of sustainability: our health, the environment and the animals, the economic and social situation of other people worldwide, and the culture into which all other dimensions are embedded.” p.5: “Sustainable food ensures that production, processing, marketing and preparation of food are as little polluting to the environment as possible.” p.6: “Sustainable food should be affordable for all people and should not cause damage to humans or the environment.” p.7: “A sustainable food supply prevents the exploitation of humans or animals or their exposure to risks.” p.8: “Sustainable food is to preserve our health and to enhance the pleasure while eating.” p.9: “Sustainable food establishes a connection to the region, to the environment, and to the people that produce the foods.”
Öko-Institut e.V. und Institut für sozial-ökologische Forschung (2007)	Germany	Report	p.6: “Sustainable food <ul style="list-style-type: none"> • is environment friendly: [...] environmental problems through production, processing or consumption of foods are as small as possible. Furthermore, sustainable food contributes to the preservation of biodiversity. • is constitutional: [...] contributes to the physical, mental and social well-being, and to more quality of life for everyone, both in private and public sphere. Sustainable food goes beyond a mere supply with healthy food and the prevention of malnutrition. • is ethically responsible: [...] supports social justice and fair trading relations both globally and regional, and fosters animal welfare. • is adequate and compatible for daily routines: (...) can be applied of consumers in their everyday life.

			<ul style="list-style-type: none"> allows for socio-cultural diversity: [...] supports the diversity of consumption habits and practices, and allows people of different cultural and social milieus, in different circumstances and phases of life to eat sustainably.”
Pack, Friedl, Lorek, Jäger, Omann, & Stocker (2005)	Austria	Report	<p>p.6: “The working definition for sustainable food consumption within this research project is:</p> <ul style="list-style-type: none"> preference for foods that have less impact on the environment and higher resource efficiency preference for local foods to imported foods preference for organically produced foods over conventionally produced foods”
Padilla, Capone, & Palma (2012)	France/Italy	Report	<p>p.231: “<i>Environment</i> Agriculture: <ul style="list-style-type: none"> follow sustainable agricultural practices enhance resilience of production systems deploy and maintain diversity Food production: <ul style="list-style-type: none"> reduce impact of production, processing, commercialization Consumption <ul style="list-style-type: none"> reduce the environmental impact of feeding practices <i>Nutrition</i> Agriculture: <ul style="list-style-type: none"> promote diverse food; produce nutritionally dense product Food Production <ul style="list-style-type: none"> preserve nutrients throughout the food chain Consumption <ul style="list-style-type: none"> promote dietary diversity, food balance and seasonality <i>Economic</i> Agriculture: <ul style="list-style-type: none"> deploy affordable cultivation practices promote self-reliance through local produce Food production:</p>

			<ul style="list-style-type: none"> strengthen local food systems produce affordable food <p>Consumption:</p> <ul style="list-style-type: none"> promote access to dietary diversity <p><i>Socio-cultural</i></p> <p>Agriculture:</p> <ul style="list-style-type: none"> maintain traditional agriculture practices and promote local varieties <p>Food production:</p> <ul style="list-style-type: none"> produce culturally acceptable food <p>Consumption:</p> <ul style="list-style-type: none"> safeguard food traditions and culture meet local preference & taste”
Sidali, Spiller, & von Meyer-Höfer (2016)	Germany	Journal Article	<p>p.145: “Environmental attributes</p> <ul style="list-style-type: none"> environmentally friendly production environmentally friendly packaging reducing greenhouse gas (GHG) emissions free from synthetic fertilizer free from chemical pesticides <p>Ethical attributes</p> <ul style="list-style-type: none"> ensuring high animal welfare ensuring fair prices for producers ensuring good working and living conditions for food producers produced without child labour <p>Health aspects</p> <ul style="list-style-type: none"> health benefits free from genetically modified organisms (GMO) natural safe no artificial additives <p>Traditional food quality attributes</p> <ul style="list-style-type: none"> good taste fresh

			<ul style="list-style-type: none"> • high nutritional value • following current trends • innovative • convenient <p>Terroir</p> <ul style="list-style-type: none"> • seasonal production • local production • traditional”
Sustain: The alliance for better food and farming (2013)	UK	Report	<p>p.1: “Sustainable food [...] should be produced, processed, bought, sold and eaten in ways that:</p> <ul style="list-style-type: none"> • Provide social benefits, such as safe and nutritious products, and improve people’s experiences of good quality food, for instance by growing and cooking it, which helps to enrich our knowledge and skills, and our cultural diversity • Contribute to thriving local economies that create good jobs and secure livelihoods – both in the UK and [...] in producer countries • Enhance the health and variety of both plants and animals (and the welfare of farmed and wild creatures), protect natural resources [...], and help to tackle climate change.”
Sustainable Development Commission (2011)	UK	Report	<p>p.13: “The sustainability of food systems invokes a complex framework of understanding [...]:</p> <ul style="list-style-type: none"> • address environmental impacts such as greenhouse gases and climate change, biodiversity, water use, land use and other infrastructure on which food depends, • contribute to human health not just by preventing food-borne diseases associated with poor safety but also non-communicable diseases due to under, as well as over, consumption, • deliver good quality food, fit to meet consumer and cultural aspirations, • embody appropriate social values such as fairness and animal welfare, • provide decently rewarded employment across the supply chain, with skills and training, • improve the above through good governance.”

Tendall, Joerin, Kopainsky, Edwards, Shreck, Le, Krutli, Grant, & Six (2015)	Switzerland/Norway/Jordan	Journal Article	p.19: "The sufficient functional goal of food systems that we prioritize here is ensuring sufficient, appropriate and accessible food to all. By sufficient, we understand sufficient quantity and nutritional quality of food; by appropriate, we include the notions of culturally, technically and nutritionally appropriate food; by accessible, we mean physically and economically accessible. [...] We thus understand food system resilience to be specific to the function of food security."
The Sustainable Restaurant Association (2015)	UK	Practical Guidelines	<p>"10 Focus Areas of Sustainability</p> <p>Celebrate Local & Seasonal</p> <ul style="list-style-type: none"> • Using local and seasonal produce [...]. <p>Serve More Veg & Better Meat</p> <ul style="list-style-type: none"> • Increasing the proportion of veg-led dishes on your menu [...], and purchasing high welfare meat and dairy products. <p>Source Fish Responsibly</p> <ul style="list-style-type: none"> • Serving sustainably caught fish [...]. <p>Support Global Farmers</p> <ul style="list-style-type: none"> • Sourcing fairly traded produce to ensure farmers in the developing world have access to a trade system based on justice and fairness <p>Treat People Fairly</p> <ul style="list-style-type: none"> • Providing equal opportunities, training and clear policies [...]. <p>Support the Community</p> <ul style="list-style-type: none"> • Engaging with the local community, with schools and charities [...]. <p>Feed People Well</p> <ul style="list-style-type: none"> • Offering balanced menu options, reasonable portions and healthy cooking options [...]. <p>Value Natural Resources</p> <ul style="list-style-type: none"> • Improving energy efficiency [...]. <p>Reduce Reuse Recycle</p> <ul style="list-style-type: none"> • Managing what comes in and goes out of your business [...]. <p>Waste No Food</p> <ul style="list-style-type: none"> • Monitoring, managing and innovating to reduce food waste."
Vermeir & Verbeke (2008)	Belgium	Journal Article	p.542: "Sustainability is defined as a combination of economic (profit), ecological (planet) and social (people) aspects. The economic aspect has to do with a fair price

			for both agricultural entrepreneurs and consumers. The ecological component involves care for the natural environment, including plant and animal production factors, the living environment in general and the quality of life for human beings. The social component finally concerns the matching of production processes with the priorities and needs of the society/citizens (in other words what is social acceptable), as well as an appreciation and support for the primary production sector from the society but also from the government (a sustainability supporting policy).”
von Koerber (2010)	Germany	Journal Article	p.263: “Seven principles for a sustainable diet: <ol style="list-style-type: none"> 1. preference for vegetarian foods (predominantly vegetables) 2. organically produced foods 3. regional and seasonal produce 4. preference for low-processed foods 5. fair trade foods 6. resource-protective budgeting 7. pleasurable and digestible dishes”

TAB. 7.1.3: ANALYSIS OF META-CATEGORIES

Meta-Category	No. of definitions containing the meta-category (N = 19)
Environment	18
Society	18
Individual/Health	17
Culture	10
Economy	5

TAB. 7.1.4: SUB-DIMENSIONS OF THE META-CATEGORY 'ENVIRONMENT'

Sub-Dimension	No. of definitions containing the dimension (N = 19)
animal welfare	7
biodiversity	7
ecosystem conservation; environmental/resource protection	10
organic production	2
resilience	3
seasonality	5
vegetable food	2

TAB. 7.1.5: SUB-DIMENSIONS OF THE META-CATEGORY 'SOCIETY'

Sub-Dimension	No. of definitions containing the dimension (N = 19)
accessibility	2
affordability	5
availability	2
community engagement	1
convenience/suitability for daily use/practicability	7
diversity and inclusion	1
equity/equality	2
fair distribution	1
governance	2
humanity	1
intergenerational justice/fairness	3
labour/working conditions/good jobs/secure livelihoods	5
labour rights/protection [of producers]	4
[supply] security	4
social justice/fairness	5
technical appropriateness	1
transparency	2

TAB. 7.1.6: SUB-DIMENSIONS OF THE META-CATEGORY 'HEALTH'

Sub-Dimension	No. of definitions containing the dimension (N = 19)
choice	1
freshness	1
local preference/taste	3
low processing	1
nutritional quality/appropriateness	8
pleasure	3
quality	3
safety	6
salubriousness	1
social health	1
sufficient quantity	1
well-being/mental health/quality of life	4

TAB. 7.1.7: SUB-DIMENSIONS OF THE META-CATEGORY 'CULTURE'

Sub-Dimension	No. of definitions containing the dimension (N = 19)
authenticity	1
cultural acceptability	2
cultural appropriateness	4
(socio-)cultural diversity	4
food culture/tradition	4
identity	1
locality	6
regionality	2

TAB. 7.1.8: SUB-DIMENSIONS OF THE META-CATEGORY 'ECONOMY'

Sub-Dimension	No. of definitions containing the dimension (N = 19)
economic development	1
fair trade/economic fairness	9
price	1
resource efficiency	9
sufficiency	1

7.2. Study II: Investigating the Determinants of Sustainable Food Travel Product Choices – A Methodological Comparison

Abstract:

Machine learning approaches are powerful tools for the analysis of non-linear data structures. One important non-linear problem in marketing research is sustainable consumer behaviour. Therefore, in this study, after a general introduction of machine learning approaches, a support vector machine model is developed to predict consumption behaviour with respect to sustainable food travel products. In addition, a logit model is developed on the same dataset. Afterwards, the two models are compared. The results show that both models reach an equally moderate overall prediction accuracy while their specific performances show some differences, e.g. regarding the recognition of positive cases.

It can be concluded that support vector machine models in practice should be used for high-dimensional, non-linear and very specific analytical problems with strong multicollinearity assumption whose theory base does not allow for the derivation of specific, directed hypotheses. Moreover, the method can be used as an alternative when the sample size does not allow for the use of a logit model. Primary field of application for logit models, in turn, should be low-dimensional problems with thematically distant predictors. For a problem that ranks between these ideal cases, such as the case at hand, both model types can be applied and complement one another.

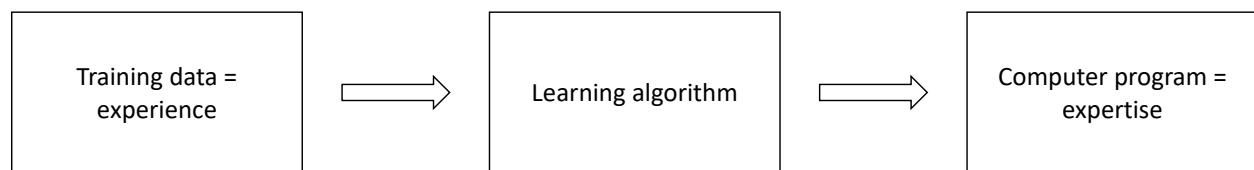
As only six of the 78 model predictors were robust against the method, a managerial implication is that travel operators that want to launch their sustainable food travel products should focus their marketing effort on these six 'robust' variables. Attitudinal criteria possess the most robust discriminatory power while sociodemographic criteria were not found to be method robust. In practice, travel operators should thus augment sustainable food options primarily for guests who show a predominantly positive attitude towards sustainable food practices in general. As most other trip characteristics do not seem to impact the choice, it can be followed that sustainable food travel products can in principle be offered on a broad range of trips.

Keywords: machine learning, support vector machines, logit regression, sustainable consumption

General Introduction/Background

Machine learning is a subarea of computer sciences and artificial intelligence which shows strong reference to statistics. The aim of machine learning approaches is to teach machines (usually computers) to independently categorize data. Through the continuous analysis of the data the machine recognizes patterns, principles, or anomalies. The machine subsequently develops ('learns') an algorithm which can be used to solve regression problems or to classify data. A regression problem is prognosis-oriented; i.e., it is searched for variables and their combination which can predict the entrance of different continuous future outcomes with the highest precision. A classification problem, in turn, is focused on the separation of cases into few maximally different groups. The task can either involve to separate an existing, concerning its characteristics possibly unique, dataset or to predict the group membership based on newly occurring data (Cristianini & Shawe-Taylor, 2000; Awad & Khanna, 2015). Although the choice of the independent variables and their directionality is usually at least partly informed by theory, the science-theoretical basis of machine learning is the principle of inductive conclusion (Shalev-Shwartz & Ben-David, 2014).

FIG. 7.2.1: PROCEDURE FOR SUPERVISED MACHINE LEARNING



An important methodological distinction can be drawn between 'supervised' and 'unsupervised' machine learning. While supervised learning requires a so-called training set of correctly classified data from which the machine derives patterns and principles, unsupervised learning works without using such a training set. The machine therefore needs to independently recognize structures in the data (Awad & Khanna, 2015; Shalev-Shwartz & Ben-David, 2014).

A further important distinction can be drawn between active and passive learning. Active learning means that the learner interacts with their environment, asks questions about the learning material, and possibly adapts it. Passive learning, in turn, implies that the learner behaves solely reactive and only uses the material provided to them from the environment. Analogous to the learning style, the role of the teacher can be active or passive. Finally, also the relation and the sequence between learning and application can vary. The learner can either continuously learn and apply their knowledge or apply their knowledge only after a longer learning phase (Shalev-Shwartz & Ben-David, 2014).

One important technique in the area of machine learning is support vector machines. These approaches try to find a hyperplane which runs between group boundaries based on data points on the very edge of

each group to be distinguished, the so-called support vectors. The optimal hyperplane maximizes the separating margin between these groups (Cristianini & Shawe-Taylor, 2000).

Data Requirements

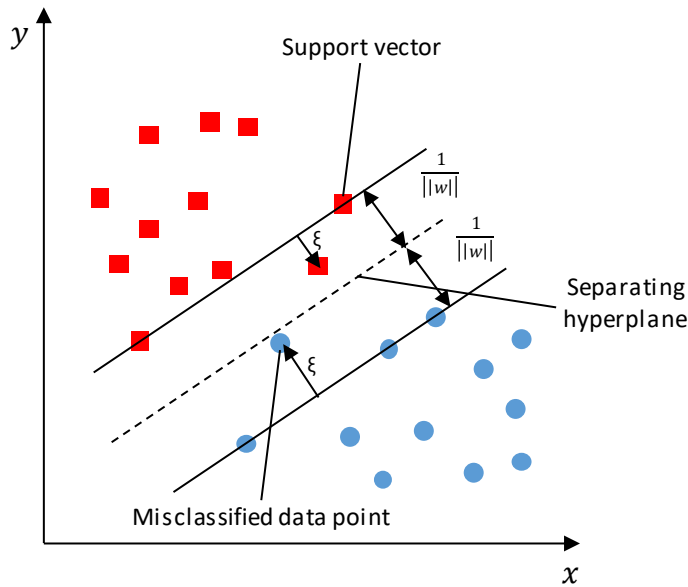
Support vector machines can work with very complex data structures; i.e., there are no requirements concerning the distribution of the independent variables, multicollinearity, autocorrelation, or linearity of the data plot. Only the linear separability of the data should be given, whereby this requirement can be loosened depending on the model specifications. Furthermore, the dependent variable should be discrete (Shalev-Shwartz & Ben-David, 2014).

In an ideal case, the dataset should be balanced; i.e., it should contain roughly an equal amount of cases of every class. An unbalanced dataset can lead to a misspecification of the algorithm as it cannot rely on sufficient positive cases. Furthermore, the algorithm's classification performance is assessed overoptimistically. If strong asymmetry prevails, the classes need to be artificially balanced (Lunardon, Menardi, & Torelli, 2014).

Furthermore, the scaling of all features should be identical to lower the influence of large absolute deviances on the specification of the algorithm. This identical scaling can be achieved through standardization. For nominal features, dummy variables need to be produced, whereby the categories are translated into binary patterns (Donges, 2017). To prevent the problem of overfitting, i.e. the development of a model which is too specific to the training data, and therefore cannot be generalized to new data, the number of features should be chosen as scarce as possible (Ben-Hur & Weston, 2009).

In the easiest case, the data structure allows for the separation into groups already in two-dimensional space. In such a situation, a simple linear function can be found that discretizes the groups. Of central importance for this function are the support vectors. These constitute the line representing the edge of each data group and define the margin between the optimally separating hyperplane and the groups to be separated. Consequently, the support vectors also determine the course of the graph of general linear hyperplane function $f(x) = \alpha + \mathbf{x}^T * \boldsymbol{\beta} = 0$ (Cristianini & Shawe-Taylor, 2000) (Tab. 7.2.2).

FIG. 7.2.2: SOFT MARGIN APPROACH



In practice, however, a direct separability of groups is rarely given; i.e., usually the data points are more or less strongly ‘mixed’. If only very few of the data points prevent the use of a linear function, so-called ‘slack variables’ can be used. This ‘soft margin approach’ allows the misclassification of data points to a certain degree – accepting a lower prognosis accuracy – so that a linear function can be found which separates the groups in two-dimensional space. The aim is to minimize the influence of the slack variables (Awad & Khanna, 2015), i.e. to minimize the objective function

$$J(w, b, \xi) = \frac{1}{2} \|w\|^2 + C \sum_{i=1}^N \xi_i$$

under the two following constraints:

$$y [w_i^T x_i + b] \geq 1 - \xi, i = 1, 2, \dots, N$$

$$\xi \geq 0, i = 1, 2, \dots, N, \text{ whereby}$$

w : separating hyperplane parameter

b : constant of the separating hyperplane

ξ : misclassified data point

C : regularization parameter

Through adjustment of the parameter C , the effect of single misclassifications on the margin of the hyperplane can be varied.

If the data are available in a form that does not allow a separation in two-dimensional space even with the soft margin approach, the use of a so-called ‘Kernel function’ is recommended. Based on Cover’s theorem, the kernel function transforms the data in a virtual high-dimensional vector space, in which they can be linearly separated through a hyperplane (Cristianini & Shawe-Taylor, 2000). The hyperplane function is then back-transformed to the low-dimensional input space so that the resulting non-linear function can also be used with untransformed input data. Different kernel functions can be applied depending on the underlying data structure, e.g. linear kernel, sigmoid kernel, polynomial kernel, or Gaussian radial basis function kernel (Awad & Khanna, 2015). The original kernel function can be stated as:

$$K(x, u) = \sum_r \varphi_r(x) \varphi_r(u)$$

whereby $\varphi(x)$ belongs to the indefinite-dimensional function space, the so-called Hilbert space.

The required sample size for supervised learning is described in the literature as relatively low. Figueroa, Zeng-Treitler, Kandula, and Ngo (2012) estimate the required minimum sample size for the training set to be between 100 and 200, whereby this number is sufficient to categorize a test set of several thousand cases. Beleites, Neugebauer, Bocklitz, Krafft, and Popp (2013) reach a 90 percent classification accuracy already with 20 training samples and a test set of at least 75 cases. Dobbin and Simon (2011) show that the ratio of the training set and the test set decreases with the strength of the effect, the reliability of the tests, the total sample size, and the number of features. As a rule of thumb, they recommend a split of $\frac{2}{3}$ to $\frac{1}{3}$ between training and test set. Furthermore, the authors recommend to repeat the procedure of choice of the training set, algorithm development, and application of the algorithm to the test set several times to corroborate the results (cross validation).

Demarcation of support vector machines from logit regression

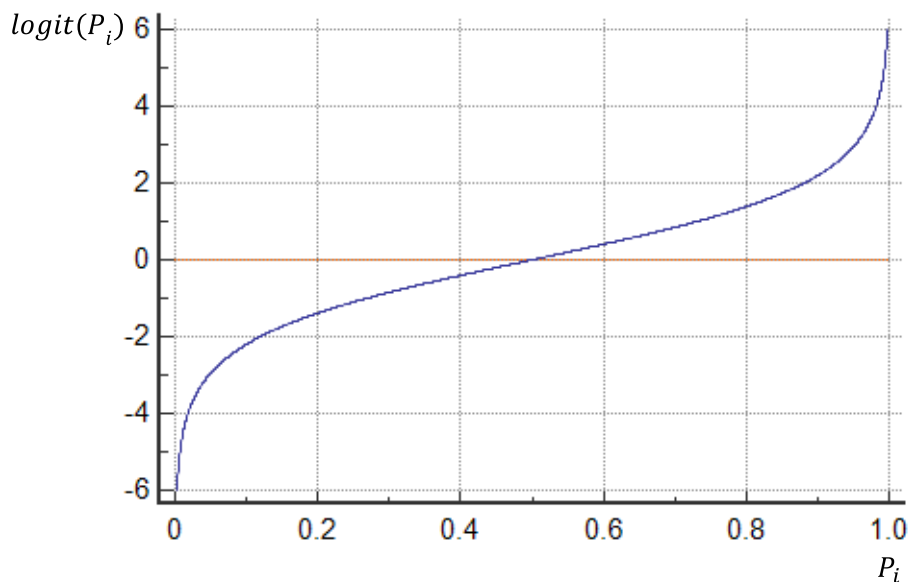
Other methods of data analysis are also suitable for classifying or predicting binary dependent variables. For example, the logit regression prognoses probabilities P for the occurrence of different outcome states. To make the method applicable, the discrete (e.g. binary) dependent variable must be transformed into a continuous variable first. In a first step, the so-called odds are calculated as the quotient of the occurrence probability of the respective outcome state and its complementary probability:

$$\frac{P_i}{1 - P_i}$$

This ratio has a lower bound of 0, while its upper bound is $+\infty$. To eliminate the effect of the lower bound, and thereby to fully linearize the target function, the so-called logit transformation is conducted. Now, the dependent variable is equal to the logarithm of the odds:

$$\eta_i = \text{logit}(P_i) = \log \frac{P_i}{1 - P_i}$$

FIG. 7.2.3: LOGIT FUNCTION



SOURCE: ADAPTED FROM [HTTPS://WWW.MEDCALC.ORG/MANUAL/LOGIT_FUNCTION.PHP](https://www.medcalc.org/manual/logit_function.php)

The transformed dependent variable can now be used for a regression model with several coefficients, analogous to other multivariate linear approaches:

$$\text{logit}(P_i) = \alpha + \beta x^T$$

transformed, this is equal to

$$\frac{P_i}{1-P_i} = e^{\alpha + \beta x^T}$$

In this case, the regression coefficients can be interpreted as the change in the log-transformed probability of the occurrence of the respective state (Rodríguez, 2007). Subsequently, the marginal contribution of every single factor to this occurrence probability can be stated after back transformation. Both logit regression and support vector machines therefore rely on linearized arguments. For this purpose, both methods transform a function; however, the logit-transformation is mathematically much less complex than the implicit mapping into a high-dimensional feature space. The logit regression model specifies the entrance probability for state '1' when using the underlying generalized linear, i.e. additive combination of independent variables and searches for a parameter combination which maximizes this entrance probability (maximum likelihood estimation) (Pampel, 2000):

$$L(P_i = 1 | \beta) | \max!$$

In principle, all data points can influence this parameter combination; i.e., the method does not only rely on a few support vectors. The requirements for the underlying data are also less rigid than for other regression methods, e.g. the ordinary least squares method. For example, logit regression does not imply the linearity of the original function. Nonetheless, this linearity needs to be achieved later through the logit transformation. Furthermore, the independent variables and the error terms do not need to be normally distributed and the error terms can show unequal variance; i.e., heteroscedasticity is acceptable. In addition, logit regression procedures are able to work with continuous, ordinal, or discrete independent variables (Stoltzfus, 2011).

Despite their relative flexibility, a range of data requirements needs to be fulfilled for logit regression models to be applicable. For example, the dependent variable must have a dichotomous structure. Furthermore, the observations must be independent of each other, i.e. there must be no autocorrelation. The logit regression is also sensitive to outliers in the data set (Stoltzfus, 2011). The model should furthermore be neither over- nor underfitted, i.e. neither contain too few nor too many predictors. In this respect, it is also important that there should not exist strong dependencies between the independent variables (multicollinearity). Finally, the sample size must be large enough to be able to determine the parameters of the estimation function with sufficient precision and to identify occurring effects unambiguously. An approximation value are 10 to 20 entrance cases per independent variable, whereby the sample size is also dependent on the strength of the effect (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996; Stoltzfus, 2011).

Applications of support vector machine models in tourism economics

An example for a regression problem in tourism economics is the prediction of tourist arrivals. Chen and Wang (2007) use the dichotomized monthly arrivals to China from 1985 to 2001 as training data for their support vector machine model. 56 of the overall 64 data points are used as the training set. Within this training set, through a cross validation procedure, different parameter constellations of the support vector machine are tested (kernel function, penalization parameter for misclassifications, variance of the kernel function), until the least complex estimation function is found whose deviations from the real function are minimal. The remaining data set then serves as the test set for this optimized estimation function. The final estimation function can subsequently be used for the prognosis of future arrivals. The support vector machine model reaches the highest prognosis accuracy compared to two alternative models, back-propagation neural networks and autoregressive integrated moving average, with an average prognosis error of 2.5%, compared to 2.7% and 3.6%, respectively.

A further application case for a regression model is the analysis of influential factors for the insolvency of hotel businesses (Li & Sun, 2012). Here, five financial ratios serve as predictors for the entrance of the insolvency. In this case, using a sample of 23 tourism and hotel businesses, the 'nearest neighbour' support vector method is applied, whereby each sample of the test set is allocated a respective sample of the training set, according to which a specific support vector machine is developed. Overall, 10 nearest neighbour support vector machines are developed in this way. The classification of the test set data uses the estimation functions of these 10 support vector machines whereby a majority decision concerning the group membership is made. As a result, the nearest neighbour support vector method reaches with an artificially balanced sample a prognosis accuracy of over 90% compared to diverse alternative support vector approaches. The group of support vector approaches in turn shows a clear advantage in prognosis accuracy of 4.5 percentage points towards a logit regression model.

A tourism-economic classification problem is the categorization of opinions of tourists concerning sights or touristic infrastructure in internet forums. Here, single expressions whose connotation is known (e.g. positive, negative, or neutral) are used as the training set to afterwards categorize text contributions automatically. The derived information can then be used for marketing purposes and is often cheaper to collect than for example via customer surveys (Philander & Zhong, 2016). In an application case, Dickinger, Lalicic, and Mazanec (2017) apply unsupervised learning to develop a 'penalized' support vector machine in order to classify a sample of 3,094 online ratings of tourists according to their used expressions into positive and negative sentiment. Overall, the feature space contains 141 expressions as dimensions. The penalized support vector machine model reaches with a roughly equally distributed sample a good forecasting performance of 74.4%.

Applications of logit regression models in tourism economics

Logit regression models are frequently used to answer tourism economic problems. Divisekera and Nguyen (2018) develop a logit regression model based on a sample of 389 touristic businesses to predict the probability for the implementation of service and marketing innovations, respectively. Their model tests nine independent variables for each type of innovation and finds significance for the predictors collaboration, human capital, foreign ownership, environmental influences, and firm size for service innovation and collaboration, information and communication technology, financial support, industry segment, firm size and competition intensity for marketing innovation. The chi square statistic of the log-ratio test of 27.78 and 83.24, respectively (each significant at the 1% level) show that the developed function explains the probability for the occurrence of both service and marketing innovations to a significant degree.

Park and Jang (2013) use a logit regression model to assess the so-called ‘choice overload’ phenomenon, represented by a connection between the number of alternative travel offers and the percentage of abdication, based on a sample of 315 questionnaires. They find a significant effect of the number of travel offers on the probability to choose none of these offers. Their logit model which uses the number of choices as the only predictor uses a polynomial function and reaches a prognosis accuracy of 78.7%.

Mao, Yang, and Wang (2018) apply logit regression to identify factors which influence the sleeping quality in hotels using a sample of 9,555 hotel reviews. Due to the multilevel data structure, they choose a ‘mixed effect ordered logit model’. The endogenous variable is here the self-reported rating of the sleeping quality in five steps, while as exogenous variables, a mix of dichotomous (airport in close proximity of hotel), nominal (gender, purpose of travel), ordinal (age groups, star classification of hotel) and continuous variables (distance from place of residence, sentiment score based on score for different hotel quality attributes) are used. Each of the nine developed models achieves a significant reduction in variance between estimation function and real function, whereby the best model overall contains 16 significant predictors.

Kim and Park (2017) apply multinomial and ‘random parameter’ logit models to a sample of 494 questionnaires to simulate the decision behaviour of consumers for hotel offers. Eight nominal and ordinal attributes of these offers (*inter alia* price, room quality, entertainment offer) are combined to 16 choice possibilities overall. A value for ρ^2 of 0.20 displays an excellent performance for the best model, a random parameter logit model.

Application example – Consumer choice prediction

In the following application example, the support vector machine method is applied with the aim of predicting the buying behaviour of consumers with respect to sustainable food travel products. Afterwards, a logit regression model is developed using the same dataset. Finally, the methods are compared along different prediction performance criteria.

Purpose of the study

Marketing research has dedicated considerable research effort to ‘green’ consumption and the ‘green’ consumer at least since the 1990s. In an early characterization, Roberts (1996, p. 222) defines ecologically conscious consumers as “those who purchase products and services which they perceive to have a positive (or less negative) impact on the environment”. Increasingly, consumers also take social considerations into account, so that the marketplace acts as a forum to articulate socio-political convictions and to press for political change (Watkins, Aitken, & Mather, 2015; Hüttel, Ziesemer, Peyer, & Balderjahn, 2017; Spaargaren & Mol, 2008). This type of consumer is also referred to as the ‘citizen consumer’ (Spaargaren, 2003) who, as a power agent, is assigned responsibility for the governance of increasingly supranational sustainability problems (Barr, Gilg, & Shaw, 2011; Ehrgartner, 2018). In tourism research, sustainable consumers have gained attention due to their potential to positively impact the destination’s economy through higher spending while having a relatively little negative or even positive impact on the environmental and social balance (Polovitz Nickerson, Jorgenson, & Bynum Boley, 2016).

In this study, it is argued that, considering the variety of interrelated factors that can influence sustainable product choices and their unclear directionality, it is likely that sustainable consumption is a high-dimensional problem which does not show a simple linear relationship to its various antecedents. Furthermore, the ambiguous results of existing studies, especially on the role of attitudes towards sustainability, make it difficult to deduct directed hypotheses *a priori*. Nonetheless, the available literature can inform the choice of the variables to be analyzed and their preprocessing (Elragal & Klischewski, 2017). Under these premises, techniques which can deal with the non-monotony and interdependence of predictors and which are neither fully theory-driven nor fully process-driven appear to be promising methodological alternatives (Elragal & Klischewski, 2017). One such methodological alternative is support vector machines. For this method to be considered beneficial, however, it must constitute an advantage over other, standard linear methods of data categorization as reflected in better model performance. One important standard method for categorization of dichotomous data is logit regression. Therefore, this method will be applied next to support vector machines within this study.

Literature review

Balderjahn, Peyer, Seegebarth, Wiedmann, and Weber (2018) distinguish six groups of consumers according to their sustainability-consciousness. With the exception of one segment, the connection between value orientation, socio-demographics and sustainable consumption behaviour is ambiguous; e.g., people who express little concern for sustainability issues may nonetheless buy sustainable products. Furthermore, buying behaviour differs among product categories; i.e., different modes of consumption coexist within the same consumer group. Martins Gonçalves, Ferreira Lourenço and Miranda Silva (2016), using a fuzzy-set qualitative comparative analysis, identify six different combinations of functional, social, emotional, conditional, and epistemic consumption values which lead to the purchase of green products. They find that the purchase decision for green products can be explained by complex interactions between these consumption values. The authors conclude that methods that take these complex interactions into account have an advantage over regression-based methods. Elliott (2013) investigates the desire for displaying social status and for differentiation from others as motives to consume green products. She finds that education as a status variable classifies consumers and thereby serves as a distinguishing element. Further significant variables are environmentalist identity, female gender, and having minor children. Other studies, in turn, find positive linear relationships between attitudes or values and sustainable consumption (do Paço, Shiel, & Alves, 2018; Jacobs, Petersen, Hörisch, & Battenfeld, 2018; Landon, Woosnam, & Bynum Boley, 2018; Paul, Modi, & Patel, 2016; Shin, Moon, Jung, & Severt, 2017).

Likewise, in the tourism context, multiple studies report the phenomenon of an attitude-behaviour gap whereby tourists report pro-sustainable attitudes while not behaving sustainably in reality (Juvan & Dolnicar, 2014; Juvan & Dolnicar, 2016). Miao and Wei (2013) show that the influence of attitude on environmental behaviour is context dependent. While in a domestic environment, consumers' moral obligations for the environment are most important, in a hotel context, hedonic and gain motives additionally determine environmental behaviour. López-Sánchez and Pulido-Fernández (2016) differentiate consumers with respect to sustainability knowledge, behaviours, attitudes, values, and willingness to pay. While for most tourists, sustainability attitude, values, and behaviours are consistent, sustainability knowledge and willingness to pay show an ambiguous relationship with behaviour. Furthermore, an analysis of market segmentation studies in tourism reveals that data from survey studies are unlikely to contain natural market segments, i.e. segments that show clear boundaries, with high internal homogeneity and external heterogeneity, and which remain stable over multiple consecutive segmentation analyses (Ernst & Dolnicar, 2018). This might be an explanation for López-Sánchez and Pulido-Fernández' (2016) finding that demand segmentation according to tourists' sustainability behaviour and attitudes is rarely conducted in practice.

With respect to food, Grunert's (2019, p.316) review finds that "there is little cumulative evidence on the existence of international segments in the food domain", owed to the fragmentary knowledge base regarding such a segment. Hansen, Ingerslev Sorensen, and Riewerts Eriksen (2018), based on a sample of Danish consumers, test the effect of environmental, health, and social consciousness, personal values, and several control variables on organic food identity and intentional organic food behaviour, respectively. They find a positive effect of health consciousness on organic food identity, whereas the effect of social consciousness is negative, and no effect of environmental consciousness is found. These relationships are partly moderated by personal values (conservation, openness to change, self-enhancement, self-transcendence). With respect to sociodemographic variables, male gender is found to negatively influence organic food identity, while age has a negative impact on intentional organic food behaviour. Education and income, however, do not show significant effects. The authors conclude that egoistic motives dominate over altruistic motives in shaping consumers' organic food identity. Kos Koklic, Golob, Podnar, and Zabkar (2019), using a sample of Slovenian adults, test the effect of past organic food consumption, environmental concern, attitudes towards organic food consumption, and personal norms on the intention to buy organic food. They find all predictors to be significant with environmental concern and past consumption having the greatest effect. Panzone, Hilton, Sale, and Cohen (2016) differentiate between implicit and explicit attitudes and find the effect of explicit attitudes to be strong, while the effect of implicit attitudes was small. With respect to sociodemographic variables, they find education to be a strong positive driver of sustainable consumption behaviour, while male gender has a negative influence, and the results for age and income are mixed. Sama, Crespo-Cebada, Díaz-Caro, Escribano, and Mesías (2018) differentiate consumers according to their preference for fair trade products and find that the groups differ in the valuation of the type of production, origin of production, and willingness to pay. Consumers preferring fair trade products are overrepresented in the middle age group (between 31 and 50 years), are significantly more educated, and have a higher income compared to the other consumer types.

Despite these mixed results of existing studies on the directionality of the predictors, it can be concluded that the main determinants of sustainable consumption in general and food consumption in particular are attitudes, sociodemographic variables, product characteristics, and daily, at home buying behaviour.

Sustainable food as an example

Food is a central component of the tourism product (McKercher, 2016) and is considered a top criterion influencing destination choice (Koc, 2013). Research indicates that the general change in consumption towards sustainable food (Greibitus, Lusk, & Nayga Jr., 2013; Tully & Winer, 2014; Sellers, 2016; De Magistris & Gracia, 2016) is increasingly reflected also in travellers' behaviour. Sustainable food is a multidimensional concept consisting of the meta-categories 'individual and health', 'society', 'economy', 'environment', and 'culture' (Antonschmidt, 2018).

However, it is not yet clear what drives the decision for sustainable food travel products on the part of consumers. This might potentially impede consistent marketing strategies and the further dissemination of the concept, since travel operators and hotels do not know which part of their clientele to approach (López-Sánchez & Pulido-Fernández, 2016).

From a methodological point of view, the concept constitutes a fruitful application field for machine learning approaches due to its multidimensional structure and the multiple interdependencies between its single dimensions. From the point of view of statistical theory, the analysis can show if machine learning approaches constitute an advantage over standard linear methods of data analysis such as logit regression. Taking a pragmatic angle, the results help to answer the following research question:

Which attitudes, sociodemographic variables, product characteristics, and purchase behaviours are method-robust predictors of sustainable food travel product choices in a package holiday context?

Data collection

The consumer data was collected via an online questionnaire which was distributed between November 2015 and January 2016 to the customer base of the three largest German tour operators and two cruise lines. A total sample of 9,070 respondents could be realized, which was reduced to 6,546 after data cleansing (Tab. 7.2.1). The package holiday travellers had to state their level of agreement with 20 different statements related to the different dimensions of sustainable food. Additional questions probed the form of diet, the characteristics of the last trip undertaken, the day-to-day food purchase behaviour, and socio-demographic data. Overall, the dataset contains seven nominal, 23 ordinal, and two numeric variables. The nominal variables were transformed into dichotomous dummy variables through the so-called ‘one hot encoding’ procedure (Donges, 2017). Dummy variables included, the dataset contains 78 features (Tab. 7.2.2, Appendix 7.2.2). In addition, all the variables were standardized by transforming them into relative shares, using the extreme point of the scale and the highest values stated, respectively, as denominator. Hence, the data set fulfils the criterion of identically scaled independent variables.

TAB. 7.2.1: SAMPLE CHARACTERISTICS

Characteristic	Category	n	%
Gender	Female	3,407	52.0
	Male	3,139	48.0
Age	18-24 years	573	8.8
	25-34 years	1,193	18.2
	35-44 years	2,331	35.6
	45-54 years	1,758	26.9

	55-64 years	630	9.6
	65 years or older	61	0.9
Place of residence	Germany	6,291	96.1
	Austria	128	2.0
	Other	127	1.9
Education	No school-leaving certificate	8	0.1
	Apprenticeship	2,597	39.7
	School-leaving certificate	833	12.7
	High school degree	797	12.2
	University degree	2,311	35.3

TAB. 7.2.2: OVERVIEW DATASET ‚SUSTAINABLE FOOD ON HOLIDAYS‘

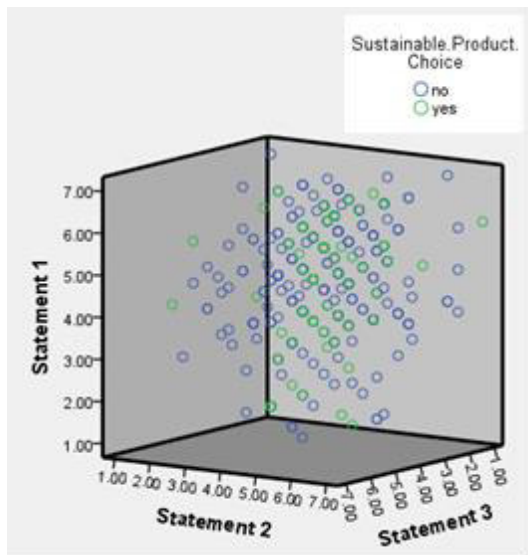
Feature category	Category description	No. of features after hot encoding
Form of diet	Vegan/vegetarian/no restrictions/other	4
Attitude towards ‘sustainable food on holidays’	Statements on regionality, freshness, amount and variety, and health and nutritional quality of food offered on holidays	20
Characteristics of last trip	Purpose of travel (categories: beach holidays; sport holidays: skiing, sailing, general summer- or winter sports; relaxation, going for a walk, enjoying landscapes; health- and wellness holidays; visits of friends and/or relatives; culture and sightseeing, city trip; shopping; event, festival; official/business trip; other holidays; cruise; experiencing the country and its people)	12
	Travel category (categories: staying with friends or relatives; standard; comfort class; first class; luxury)	1
	Destination (country)	10
	Travel companionship (categories: alone; with my partner; with children under 15; with other relatives; with friends; with other persons)	6
	Type of board (categories: no fixed board; breakfast; half board; full board; all inclusive; catering from friends or relatives)	1
	Duration of last trip (no. of nights)	1
	Day-to-day food purchase behaviour	Preference for food qualities such as freshness, affordability, seasonality etc.
Socio-demographics	Gender	2
	Age	1
	Place of residence	3
	Education	1
Total		78

The dependent variable is the result of a choice experiment whereby the respondents were offered different virtual travel packages and ranked them according to their attractiveness (Tab. 7.2.3, Appendix 7.2.1). Those respondents who ranked the most sustainable offer (Alternative 1) as the most attractive were classified as ‘sustainable consumers’, all other cases as ‘less sustainable consumers’. As a result, the data set contains 1,179 ‘sustainable consumers’ (18.6%) and 5,147 ‘less sustainable consumers’ (81.4%). The visualization of the data structure highlights the problem - already in low dimensional space, no hyperplane can be found to linearly separate the groups (Fig. 7.2.4). With $x \in \mathbb{R}^{78}$, this problem increases considerably.

TAB. 7.2.3: OVERVIEW OF CHOICE ALTERNATIVES

Alternative	Characteristics
1	Organic food, regional food, reduced food offer, price € 800
2	Reduced food offer, price € 800
3	Regional food, reduced food offer, price € 700
4	Regional food, full food offer, price € 600
5	Organic food, full food offer, price € 700
6	Organic food, regional food, full food offer, price € 800
7	Full food offer, price € 800
8	Organic food, reduced food offer, price € 600

FIG. 7.2.4: DATA STRUCTURE IN THREE-DIMENSIONAL FEATURE SPACE



Development of the support vector machine model

To solve this problem, a support vector machine model is developed. The model uses supervised learning since it can build on a correctly classified training data set. The aim is to develop an algorithm which is able to produce a hyperplane that separates the two consumer groups as accurately as possible and which can subsequently be used to separate also formerly unknown data into two groups. Building on a set of training data $\frac{n}{k}$, the classification algorithm to be developed is to classify a point $x \in \mathbb{R}^n$ of a test set $n - \frac{n}{k}$ to $y \in \{-1, +1\}$ while minimizing classification error (Fischetti, 2016).

For the development and evaluation of the support vector machine model, the R program (version 3.5.3) with the packages 'kernlab', 'e1071', and 'rminer' was used (Karatzoglou, Smola, Hornik, & Zeileis, 2004; Meyer, 2017; Cortez, 2016). The implementation procedure was geared to Karatzoglou, Meyer, and Hornik (2006). Following the recommendation from Dobbin and Simon (2011), the data set was divided into 4,364 (66.7%) training cases and $6,546 - 4,364 = 2,182$ test cases (33.3%). The data set was artificially balanced with the so-called SMOTE (synthetic minority oversampling technique) procedure that creates additional positive cases based on the existing cases of this minority class. For this task, the R package 'DMwR' was used (Torgo, 2015):

```
> Sus.Food.Train<-Sus.Food[1:4364,]

> Sus.Food.Train.Smote<-SMOTE(Sustainable.Product.Choice~,Sus.Food.Train,per.over=200,perc.under=150,k=5)
```

The transformed data set is now balanced regarding positive and negative cases. As the next step, the parameters of the support vector machine are to be specified. An important determination in this respect is the choice of an appropriate kernel function. The four most frequently used kernel functions are linear kernel, sigmoid kernel, polynomial kernel, and radial basis function kernel (Lin & Lin, 2003). A linear kernel is most useful if the number of features is already very high and considerably exceeds the numbers of cases so that a mapping into a higher dimensional feature space would not improve the classification accuracy. Furthermore, the kernel function should be chosen according to the actual data structure in input space. A linear kernel is best suited if the groups in input space appear generally separable through a transformed linear function (Hsu, Chang, & Lin, 2016). The same holds for polynomial kernel which use a polynomial function and for sigmoid kernel which use a hyperbolic function (Lin & Lin, 2003).

Since in the present case the number of features is relatively small compared to the number of cases, and since the data structure does not indicate a potentially suitable separation function, a Gaussian radial basis function kernel was chosen. Regarding the data structure with a low number of features and a very irregular class border in input space, this kernel is able to define – through an exponential transformation

of the feature vectors – a sufficiently complex ‘feature space’ with potentially unlimited dimensionality (Hsu et al., 2016). The kernel function can be specified as:

$$K(x, u) = \exp(-\gamma \|x - u\|^2),$$

whereby:

$\gamma = \frac{1}{2\sigma^2}$ = parameter of the kernel transformation

$\|x - u\|^2$ = squared Euclidean distance between feature vectors

The fit function in the package ‘rminer’ adjusts the model to the data structure and also allows for a range of important specifications.

```
> fitmodel<-fit(Sustainable.Product.Choice ~ ., data = Sus.Food.Train.Smote, model = "svm", task =
  "class", search = "grid", cross = 10)
```

The R command above specifies that all 78 features are to be used for the classification of the groups and that the product choice builds the classification attribute. The model is specified as a support vector model (model = "svm") which is to classify data (task = "class"). This model type uses a Gaussian radial basis function kernel by default. Furthermore, a so-called grid search procedure was applied (search = "grid"). This procedure serves to find a combination of the parameter of the kernel transformation γ and the slack parameter C which optimally represents the actual separation function in input space. Therefore, γ and C are varied and the model performance is assessed based on the resulting misclassification rate of a small part of the training set (Karatzoglou et al., 2006). For the final model, the combination of γ and C that yields the lowest misclassification rate is used.

To corroborate the results of the model, a 10-fold cross validation procedure was embedded. Here, support vector machines are developed for $k - 1$ subsets of the data which are then tested on the remaining dataset. This procedure is repeated k times. The final model contains the model specification which, on average over the k submodels, minimizes the difference between predicted and actual data (Xu, 2012; Chen & Wang, 2007).

Results

The R output for the support vector model yields:

```
Support Vector Machine object of class "ksvm"
```

SV type: C-svc (classification)

parameter : cost C = 1

Gaussian Radial Basis kernel function.

Hyperparameter : sigma = 0.00825492907323319

Number of Support Vectors : 2588

Objective Function Value : -1835.976

Training error : 0.110727

The optimal classification performance for the training set measured by classification error was achieved with a parameter specification of $C = 1$ and $\sigma = 0.008$. From the high number of support vectors (2,588) in relation to the overall number of classification cases (4,344), it can be followed that the data needed to be transformed into a very high dimensional space to be separable.

Model evaluation

As the class boundary in input space runs very irregular and hence is based on a nonlinear function, the evaluation of the relevance of single features is much more complicated than with linear regression models, where the marginal contribution of single variables is equal to their beta coefficient. A heuristic, however, constitutes the evaluation of the importance of single features. For this purpose, the importance statistic measures the sensitivity of the hyperplane to the exclusion of a single feature: the higher the sensitivity of the hyperplane, the higher the feature's importance. Common measures for sensitivity are absolute deviation or variance. For this analysis, variance is used (Molnar, 2019). To assess the feature importance statistic, the model was slightly adjusted so that the predicted outcome is now probabilities instead of binary states:

```
> fitmodel<-fit(Sustainable.Product.Choice ~ ., data = Sus.Food.Train.Smote, model = "svm", task =
  "prob", search = "grid", cross = 10)
```

```
> imp<-Importance(fitmodel, Sus.Food.Train.Smote, Reall = 7, method = "sensv", measure = "variance")
```

Tab. 7.2.4 lists the 15 most important features whose omission had a considerable effect (importance ≥ 0.01). It should be noted, however, that the directionality of the relationship between feature and dependent variable cannot be concluded from the importance statistic. As an indicator, bivariate associations with the membership in the two different groups were analysed.

TAB. 7.2.4: FEATURE IMPORTANCE EVALUATION

Feature no.	Feature category	Feature meaning	Feature importance statistic	Association with group
31	Characteristics of last trip	Purpose of travel: Shopping	0.41	0
23	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, freshly-prepared food without any convenience products is important to me."	0.17	1
32	Characteristics of last trip	Purpose of travel: Event, Festival	0.12	0
1	General food consumption behaviour	Statement: "I am vegan."	0.08	1
19	Attitude towards 'Sustainable food on holidays'	Statement: "Travel companies should not only meet but exceed social standards (i.e. working conditions for employees) even if the price increases for me."	0.04	1
18	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, I prefer a decent meal regardless of any leftovers."	0.03	1
55	Characteristics of last trip	Duration of last trip (no. of nights)	0.03	1
34	Characteristics of last trip	Purpose of travel: other holidays	0.02	0
75	Socio-demographics	Country of residence: other than Germany/Austria	0.01	0
28	Characteristics of last trip	Purpose of travel: Health- and Wellness holidays	0.01	1
52	Characteristics of last trip	Travel companionship: friends	0.01	0
20	Attitude towards 'Sustainable food on holidays'	Statement: "Travel companies should not only meet but exceed ecological standards (i.e. responsible waste- and sewage handling) even if the price increases for me."	0.01	1
7	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, eating organic food is important to me."	0.01	1
44	Characteristics of last trip	Trip destination: Turkey	0.01	0

41	Characteristics of last trip	Trip destination: Greece	0.01	0
----	------------------------------	--------------------------	------	---

From the analysis of the feature importance statistic, it can be concluded that characteristics of the last trip, certain attitudes towards ‘Sustainable food on holidays’, and a vegan orientation are more important for the choice of sustainable food travel products compared to socio-demographics, and day-to-day purchase behaviour.

The classification accuracy of the support vector machine model based on the developed algorithm can be assessed via a contingency table that compares the classification results of the model to the actual composition of the training set. Tab. 7.2.5 shows that the model correctly classifies 3,883 cases, a classification accuracy of 89.4%. The algorithm is able to correctly classify the vast majority of cases, whereby the classification accuracy for positive cases – ‘sustainable consumers’ – (92.0%) ranks above the accuracy for negative cases, ‘less sustainable consumers’ (86.8%).

TAB. 7.2.5: CLASSIFICATION PERFORMANCE SVM MODEL ON KNOWN DATA

		observed class	
		less sustainable consumer	sustainable consumer
predicted class	less sustainable consumer	1,885	174
	sustainable consumer	287	1,998

In the next step, the algorithm is applied to the test set consisting of the remaining cases. This serves to validate the model performance with formerly unknown data.

```
> Sus.Food.Test<-Sus.Food[4345:6546,]
> pred<-predict(model,Sus.Food.Test)
> (acc<-table(pred,Sus.Food.Test)$Sustainable.Product.Choice)
> classAgreement(acc)
```

It is tested if the developed algorithm can also classify formerly unknown data correctly into ‘sustainable consumers’ and ‘less sustainable consumers’. This task is more challenging as an orientation-providing, definitely correctly classified training set is lacking. Under these conditions, the support vector machine model classifies 1,699 cases correctly, a prognosis accuracy of 77.2% (Tab. 7.2.6).

TAB. 7.2.6: CLASSIFICATION PERFORMANCE SVM MODEL ON UNKNOWN DATA

		observed class	
		less sustainable consumer	sustainable consumer
predicted class	less sustainable consumer	1,508	124
	sustainable consumer	379	191

The classification results show that the developed support vector machine model can also classify formerly unknown data mostly correctly into the two groups. In contrast to the training model, the test model is more precise when identifying negative cases (79.9%) than positive cases (60.6%).

The model performance can be further evaluated through a comparison to the so-called ‘proportional chance criterion’. This measure takes into account the distribution of the observed cases. The statistic $relative\ class\ size^2 + (1 - relative\ class\ size)^2 = 0.857^2 + (1 - 0.857)^2 = 0.755 = 75.5\%$ indicates that the advantage of the SVM model compared to a random assignment is 1.7 percentage points. When evaluating this result, however, it should be considered that the proportional chance criterion statistic increases with the inequality of the relative class sizes and consequently constitutes a very strict performance criterion for the case at hand (Sanchez, 1974). A less conservative statistic, the Cohen’s kappa statistic $\frac{observed\ accuracy - expected\ accuracy}{1 - expected\ accuracy} = \frac{0.772 - 0.672}{1 - 0.672}$, specifies the ‘net’ advantage of the support vector machine model over a naive model to be 30.3% or 9.9 percentage points (Tab. 7.2.7).²

TAB. 7.2.7: PERFORMANCE EVALUATION SVM MODEL

Criterion	Performance
Prognosis accuracy	77.2%
Sensitivity	60.3%
Specificity	79.9%
Diff. to proportional chance criterion (percentage points)	1.7
Cohen’s kappa	30.3%

² Expected accuracy: $\frac{(1,508+124) \times (1,508+379)}{2,202}$

Development of the logit regression model

To comparatively evaluate the classification performance of the support vector machine model, it is to be compared to a standard approach to classify binary dependent variables, the logit regression. Although a logit model does not require a balanced dataset, in this case the dataset balanced with the SMOTE procedure is used again to ensure comparability. Other, critical requirements for the use of a logit model are fulfilled in the dataset as the observations are independent of each other, the dataset contains considerably more than 20 positive cases per independent variable, and the influence of extreme values is reduced through the standardization of the variables. The number of dummy variables was reduced by one for each nominal variable to create a reference group for the regression model and to avoid multicollinearity problems (Jaccard, 2001).

51 cases of the variable 'v_46_Übern – duration of last trip' that appeared unrealistically high and additionally showed z values above 3.29 even after standardization were excluded from the dataset (Field, 2005). As a boxplot still indicated the presence of several outliers even after the exclusion, the values were furthermore transformed into square roots. Nonetheless, the transformed variable still yielded unrealistically high and unstable coefficient estimates (exponentiated coefficient > 1,000). Therefore, it was decided to exclude the predictor from the further analysis. 10 further cases of the variable 'travel companionship' were excluded as they showed missing data for every category.

To build the logit model, the R package 'glm2' was used (Marschner & Donoghoe, 2018). The R command states the regression model. Furthermore, the nature of the dependent variable is specified as binary and the 'link' to linearize the dependent variable is specified as the logit function. Similar to the SVM model, the logit model was developed based on the training data set before being validated with the test data set.

```
> Log.Model<-glm(formula = Sustainable.Product.Choice ~ ., family = binomial(link="logit"), data =
  Sus.Food.Train.Smote)
```

```
> summary(Log.Model)
```

Results

Due to the high number of predictors and their thematic closeness, linear dependencies (multicollinearity) between the predictors could prevail. To check the model in this respect, the R package 'car' was used (Fox, Weisberg, & Price, 2018). The results showed strong multicollinearity ($VIF \geq 10$) between the predictors 'v_41_Rzweck_1' – beach holidays, 'v_41_Rzweck_3' – relaxation, going for a walk, enjoying land-

scapes’, and ‘v_41_Rzweck_11’ – cruise. From the variance inflation (VIF) statistic and the additional analysis of a correlation matrix, it was concluded that ‘v_41_Rzweck_11’ was the most strongly affected predictor. Consequently, it was excluded from the further analysis (Midi, Sarkar, & Rana, 2010). After the treatment, the VIFs for all predictors showed values clearly below 10.

Of the remaining 71 predictors (excluding reference categories), only 30 contribute significantly to the prognosis of the dependent variable ($p < 0.05$). Following, the final model can be specified as:

$$\begin{aligned}
 & \textit{Logit (choice of the most sustainable offer)} \\
 = & -5.333 + 2.209 v_5_{Bio} - 0.690 v_6_{Fleisch} + 0.769 v_8_{landtyp} \\
 & + 0.523 v_{11_unges} + 1.642 v_{13_vollAusw} + 0.934 v_{16_Portgr} \\
 & + 0.676 v_{17_sozStand} + 0.962 v_{18_ökStand} - 0.563 v_{20_Kennz} \\
 & + 2.111 v_{41_Rzweck_2} - 0.926 v_{43_RLand_92} + 0.694 v_{43_RLand_228} \\
 & + 0.822 v_{43_RLand_241} - 1.015 v_{43_RLand_249} - 0.395 v_{43_RLand_other} \\
 & - 0.728 v_{44b_RPartner} - 0.647 v_{44d_RFam} - 1.287 v_{44e_RFreu} \\
 & - 0.872 v_{45_Verpf} + 0.342 v_{51a_frisch} - 0.533 v_{51b_günst} \\
 & + 0.255 v_{51d_gen} + 0.447 v_{51e_artger} + 0.226 v_{51i_natur} \\
 & - 0.433 v_{51j_Marke} + 0.210 v_{51k_Zuck} + 0.968 v_{51m_bio} \\
 & + 0.383 v_{51o_allerg} + 2.402 v_{61_alt} - 0.751 v_{64_Ausb}
 \end{aligned}$$

This can be transformed into

$$\begin{aligned}
 & \textit{Odds (choice of the most sustainable offer)} \\
 = & \frac{P}{1 - P} = e^{-5.333 + 2.209 v_5_{Bio} [\dots] - 0.751 v_{64_Ausb}}
 \end{aligned}$$

Probability (choice of the most sustainable offer)

$$= P = \frac{e^{-5.333 + 2.209 v_5_{Bio} [\dots] - 0.751 v_{64_Ausb}}}{1 + e^{-5.333 + 2.209 v_5_{Bio} [\dots] - 0.751 v_{64_Ausb}}}$$

Due to the curvilinear course of the probability function graph, the marginal predictor contribution varies with the value of this predictor and turns out higher in the extreme ends than in the middle range. This complicates the interpretation which is why in this case, the ‘odds’ function is used to determine the marginal predictor contribution. The higher the absolute difference of the exponentiated coefficient towards the uninfluential coefficient of 1, the higher the impact of the corresponding predictor on the odds for choosing a sustainable product (Pampel, 2000). On this basis, the influence of the single variables can be precisely stated (Tab. 7.2.8).

TAB. 7.2.8: EVALUATION OF THE MARGINAL VARIABLE CONTRIBUTION

Variable name	Variable category	Variable meaning	Exp. coeff.	1 – exp. coeff.	Directionality
v_61_alt	Socio-demographics	Age	11.045	10.045	+
v_5_Bio	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, eating organic food is important to me."	9.107	8.107	+
v_41_Rzweck_2	Characteristics of last trip	Purpose of travel: Sport holidays: Skiing, sailing, general summer- or winter sports	8.256	7.256	+
v_13_vollAusw	Attitude towards 'Sustainable food on holidays'	Statement: "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."	5.165	4.165	+
v_51m_bio	Day-to-day food purchase behaviour	organic products	2.631	1.631	+
v_18_ökStand	Attitude towards 'Sustainable food on holidays'	Statement: "Travel companies should not only meet but exceed ecological standards (i.e. responsible waste- and sewage handling) even if the price increases for me."	2.616	1.616	+
v_16_Portgr	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, I prefer a decent meal regardless of any leftovers."	2.544	1.544	+
v_43_RLand_241	Characteristics of last trip	Trip destination: USA	2.275	1.275	+
v_8_landtyp	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, I prefer local meals to familiar ones I know from home."	2.157	1.157	+

v_43_RLand_228	Characteristics of last trip	Trip destination: Turkey	2.003	1.003	+
v_17_sozStand	Attitude towards 'Sustainable food on holidays'	Statement: "Travel companies should not only meet but exceed social standards (i.e. working conditions for employees) even if the price increases for me."	1.967	0.967	+
v_44e_RFreu	Characteristics of last trip	Travel companionship: With friends	0.276	0.724	-
v_11_unges	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, I don't mind eating in an unhealthy way or to commit 'food sins'."	1.688	0.688	+
v_43_RLand_249	Characteristics of last trip	Trip destination: Austria	0.362	0.638	-
v_43_RLand_92	Characteristics of last trip	Trip destination: Italy	0.396	0.604	-
v_45_Verpf	Characteristics of last trip	Type of board	0.418	0.582	-
v_51e_artger	Day-to-day food purchase behaviour	Animal welfare products	1.564	0.564	+
v_64_Ausb	Socio-demographics	Education	0.472	0.528	-
v_44b_RPartner	Characteristics of last trip	Travel companionship: With my partner	0.483	0.517	-
v_6_Fleisch	Attitude towards 'Sustainable food on holidays'	Statement: "On vacation, I try to eat little or no meat at all."	0.501	0.499	-
v_44d_RFam	Characteristics of last trip	Travel companionship: With other family members	0.524	0.476	-

v_51o_allerg	Day-to-day food purchase behaviour	Day-to-day food purchase behaviour: suitable for allergic persons	1.467	0.467	+
v_20_Kennz	Attitude towards 'Sustainable food on holidays'	Statement: "Hotels or cruise lines that offer sustainable food should be marked accordingly in travel catalogues or online."	0.570	0.430	-
v_51b_günst	Day-to-day food purchase behaviour	Low price	0.587	0.413	-
v_51a_frisch	Day-to-day food purchase behaviour	Fresh produce	1.408	0.408	+
v_51j_Marke	Day-to-day food purchase behaviour	Known food brands	0.648	0.352	-
v_43_RLand_other	Characteristics of last trip	Trip destination: Other destination	0.674	0.326	-
v_51d_gen	Day-to-day food purchase behaviour	Genetically unmodified products	1.290	0.290	+
v_51i_natur	Day-to-day food purchase behaviour	Natural products	1.254	0.254	+
v_51k_Zuck	Day-to-day food purchase behaviour	Foods with little sugar	1.233	0.233	+

From the results it can be seen that, with the exception of form of diet, predictors from all categories are represented and have a significant influence on the chances to choose a sustainable food travel product. The directionality of the coefficients is not always intuitive; e.g., a less sustainable attitude also increases the chances to choose the most sustainable product. It is furthermore noticeable that all forms of travel companionship have a negative impact on the chances to choose a sustainable product.

Model evaluation

Analogous to the SVM model, the classification accuracy of the logit model can be assessed via contingency tables.

TAB. 7.2.9: CLASSIFICATION PERFORMANCE LOGIT MODEL ON KNOWN DATA

		observed class	
		less sustainable consumer	sustainable consumer
predicted class	less sustainable consumer	1,671	403
	sustainable consumer	420	1,688

With the guidance of the training set, the logit model correctly classifies 3,359 cases (80.3%). Similar to the SVM model, the classification accuracy for positive cases (80.7%) ranks above that for negative cases (79.9%).

Analogous to the SVM model, the logit model is subsequently applied to the test set to evaluate its prognosis accuracy:

```
> pred <- round(predict(Log.Model, Sus.Food.Test, type="response"))
> (acc<-table(pred,Sus.Food.Test$Sustainable.Product.Choice))
```

TAB. 7.2.10: CLASSIFICATION PERFORMANCE LOGIT MODEL ON UNKNOWN DATA

		observed class	
		less sustainable consumer	sustainable consumer
predicted class	less sustainable consumer	1,522	152
	sustainable consumer	315	173

When using unknown data, the logit model classifies 1,695 cases (78.4%) correctly. As with the SVM model, the rank order of the classification performance changes and is for the test model higher for negative cases (82.9%) than for positive cases (53.2%).

Similar to other regression approaches such as the ordinary least squares (OLS) method, the prognosis accuracy of the model can be described relative to a ‘null’ model without any predictors. A difference to the OLS method is that the variance reduction is not equivalent to the reduction in the sum of squares. Therefore, the statistic for the logit model is also called ‘pseudo’ R² (Pampel, 2000):

$$\text{pseudo } R^2 = \frac{(\text{variance of the null model} - \text{variance of the test model})}{\text{variance of the null model}} = \frac{(5797.5 - 3672.6)}{5797.5} = 0.367 = 36.7\%.$$

`> classAgreement(acc)`

`> roc <- roc(Sustainable.Product.Choice~pred, Sus.Food.Test)`

`> plot(roc)`

Also the logit model reaches only a small advantage over the proportional chance criterion while Cohen’s kappa appears again more favourable.

TAB. 7.2.11: PERFORMANCE EVALUATION LOGIT MODEL

Criterion	Performance
Prognosis accuracy	78.4%
Sensitivity	53.2%
Specificity	82.9%
Diff. to proportional chance criterion (percentage points)	3.9
Cohen’s kappa	29.9%

Model performance comparison

A comparison of the model performances along different prediction performance criteria shows that the SVM model and the logit model perform nearly equally moderate (Tab. 7.2.12).

TAB. 7.2.12: MODEL PERFORMANCE COMPARISON

Criterion	SVM model	Logit model
Prognosis accuracy	77.2%	78.4%
Sensitivity	60.6%	53.2%
Specificity	79.9%	82.9%
Diff. to proportional chance criterion (percentage points)	1.7	3.9
Cohen’s kappa	30.3%	29.9%

To finally evaluate the differences between the models with respect to their managerial implications, the feature importance statistics of the SVM model and the logit model’s significant exponentiated coefficients of the Odds function were compared, as both statistics state the contribution of single predictors for the classification into one of the classes of the dependent variable. Tab. 7.2.13 states the 15 features with the highest ‘importance’ values and the highest beta coefficients, respectively. It can be concluded that both similarities and differences exist between the models. Overall, six of the 15 most important predictors (in bold) can be found in both models.

Attitudinal criteria possess the most robust discriminatory power for sustainable food travel product choices while sociodemographic criteria were not found to be method robust. Of the 31 ‘Characteristics of the last trip’ only two are represented in both models. Overall, the results highlight the fruitfulness to corroborate findings on the determinants of sustainable product choices through the use of different methods.

TAB. 7.2.13: MOST IMPORTANT PREDICTORS BY MODEL

Rank	SVM model (feature importance)	Logit model (1 – exp. coeff.)
1	Purpose of travel: Shopping	Age
2	Statement: “On vacation, freshly-prepared food without any convenience products is important to me.”	Statement: “On vacation, eating organic food is important to me.”
3	Purpose of travel: Event, festival	Purpose of travel: Sport holidays: Skiing, sailing, general summer- or winter sports
4	Statement: “I am vegan.”	Statement: “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.”
5	Statement: “Travel companies should not only meet but exceed social standards (i.e. working conditions for employees) even if the price increases for me.”	Day-to-day food purchase behaviour: organic products
6	Statement: “On vacation, I prefer a decent meal regardless of any leftovers.”	Statement: “Travel companies should not only meet but exceed ecological standards (i.e. responsible waste- and sewage handling) even if the price increases for me.”

7	Duration of last trip (no. of nights)	Statement: “On vacation, I prefer a decent meal regardless of any leftovers.”
8	Purpose of travel: Other holidays	Trip destination: USA
9	Country of residence: Other than Germany/Austria	Statement: “On vacation, I prefer local meals to familiar ones I know from home.”
10	Purpose of travel: Health- and Wellness holidays	Trip destination: Turkey
11	Travel companionship: Friends	Statement: “Travel companies should not only meet but exceed social standards (i.e. working conditions for employees) even if the price increases for me.”
12	Statement: “Travel companies should not only meet but exceed ecological standards (i.e. responsible waste- and sewage handling) even if the price increases for me.”	Travel companionship: Friends
13	Statement: “On vacation, eating organic food is important to me.”	Statement: “On vacation, I don’t mind eating in an unhealthy way or to commit ‘food sins’.”
14	Trip destination: Turkey	Trip destination: Austria
15	Trip destination: Greece	Trip destination: Italy

Conclusion and Discussion

From the classification results and the further model evaluation it becomes clear that both models are able to predict the dependent variable with moderate accuracy.

A challenge for the support vector machine model is the evaluation of the relevance of single features, especially due to the non-linear logic of the investigated relationship. Consequently, it is not possible to assign parameter values to the features as for example with linear regression models and to state the marginal contribution of single features in this way. This makes the managerial interpretation of the results difficult. Also, the directionality between features and the dependent variable cannot be comprehended directly but needs to be derived from bivariate associations and secondary sources. Nonetheless, the feature importance statistic offers the possibility to produce a rank order of features.

The results of the logit model show a higher usability for management decisions, as the marginal contribution of single predictors can be clearly stated when using the exponentiated coefficients of the ‘odds’ function. At the same time, the logit model is prone to misinterpretations regarding the significance and directionality of predictors, respectively, if their linear dependencies are disregarded. To prevent such

multicollinearity problems, variables possibly need to be left out, so that the final model may not contain all significant predictors. These problems are likely to increase, the more predictors are investigated.

Finally, it can be concluded that support vector machine models in practice should be used for high-dimensional, non-linear and very specific analytical problems with strong multicollinearity assumption whose theory base does not allow for the derivation of specific, directed hypotheses. Moreover, the method can be used as an alternative when the sample size does not allow for the use of a logit model. Primary field of application for logit models, in turn, should be low-dimensional problems with thematically distant predictors. For a problem that ranks between these ideal cases, such as the case at hand, both models can be applied and complement one another.

Managerial implications

As represented in the comparison of the most important predictors, the methods did not converge and only six of the 78 predictors are robust against the method. This calls for caution regarding the managerial interpretation of the results as marketing strategies that disregard this method sensitivity may lead to suboptimal decisions, such as e.g. offering sustainable food products with the ‘wrong’ trip types. Such a situation should be prevented as it might needlessly reduce the consumer acceptance of the concept of sustainable food.

Therefore, travel operators that want to market their sustainable food travel products should focus their marketing effort on the six ‘robust’ variables. Sustainable food options should be offered especially to guests who show a predominantly positive attitude towards sustainable food practices in general. Furthermore, people who travel with friends should not be the primary target group for sustainable food travel products. Since most other trip characteristics do not seem to impact the choice, it can be followed that sustainable food travel products can in principle be offered on a broad range of trips.

A promising avenue to identifying discriminatory traveler characteristics for travel operators is to find out more about their guests’ attitudes towards sustainable food. Favourable guest attitudes could then be activated e.g. through tailored communication tools to encourage consumption of sustainable food products.

Limitations

From a science-theoretical point of view, machine learning approaches such as SVM might be accused of fostering empiricism, as they in principle require only rudimentary hypotheses *a priori*. Consequently, the methods are prone to the infamous ‘garbage in/garbage out’ problem and the results might only have

limited theoretical value. Nonetheless, in the present case, the assumption of non-linearity can be considered as partly theory-guided, since it reflects the ambiguous evidence in the literature on the determinants of sustainable consumption. In such a situation, an inductive approach can be a useful landmark on the way towards a holistic, corroborated theory and related hypotheses.

Some further general limitations should be noted. First, the construct validity of the questionnaire-based non-consequential choice experiment might be low, and it is unclear whether tourists would show their reported behaviour also in a consequential, real-life choice experiment, especially in the light of the addressed attitude-behaviour gap. The use of a standardized questionnaire furthermore limits the range of considered variables to those which can easily be assessed via measurement scales.

Since the study let the same participants assess both the independent variables and the dependent variable via similar measurement scales, common method bias could be an issue (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Of its various types as differentiated by Podsakoff et al. (2003), the consistency motif, implicit theories and illusory correlations, and social desirability appear to be the most likely biases. The implicit theory bias was addressed by not stating the rationale of the research in the introduction of the questionnaire. An attempt to reduce the social desirability bias was made by using neutral and binding language (Paulhus, 1991). To lower the consistency motif, different sections of the questionnaire were displayed on different web pages. This procedure aims at adding a psychological separation for respondents towards their previous answers (Podsakoff et al., 2003).

Finally, the representativeness of the sample was lowered because the respondents as the sampling units could not be chosen by chance but were rather determined by the contracting travel operators. A considerable sample bias also exists because the respondents in the sample were limited to German speaking package travellers who booked a tour with one of the travel operators within the preceding year. Accordingly, the findings cannot necessarily be generalized to the whole segment of package travellers or other tourist segments. Nonetheless, the results should be representative for the German package holiday market.

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Appendices

APPENDIX 7.2.1: INTRODUCTORY TEXT TO THE CHOICE EXPERIMENT (TRANSLATED FROM GERMAN)

Please imagine you book the following holidays: one week stay in a four star beach hotel with all-inclusive board arrangement. You travel with one accompanying person. With respect to the food and drinks offer, several options in different compositions are available: organic food, no organic food, regional products, no regional products, full food offer, reduced food offer to prevent waste.

Please rank the alternatives below by moving them from left to right, starting with the most attractive offer for you (the more attractive the offer, the higher should be the rank).

APPENDIX 7.2.2: OVERVIEW OF THE VARIABLES OF THE DATASET

Feature no.	Name	Meaning
1	v_1_ErnV_1	Statement: "I am vegan."
2	v_1_ErnV_2	Statement: "I am vegetarian."
3	v_1_ErnV_3	Statement: "I do not have any dietary restrictions."
4	v_1_ErnV_4	Statement: "I prefer another form of diet."
5	v_3_Lmreg	Statement: "On vacation, regionally-produced food is important to me."
6	v_4_Fair	Statement: "On vacation, eating fair-trade food is important to me."
7	v_5_Bio	Statement: "On vacation, eating organic food is important to me."
8	v_6_Fleisch	Statement: "On vacation, I try to eat little or no meat at all."
9	v_7_Inh.Nähr	Statement: "On vacation, I pay attention to ingredients and nutritional values of dishes."
10	v_8_landtyp	Statement: "On vacation, I prefer local meals to familiar ones I know from home."
11	v_9_herk	Statement: "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)."
12	v_10_Kultur	Statement: "Consuming local food and drinks is a good way to become acquainted with other cultures."
13	v_11_unges	Statement: "On vacation, I don't mind eating in an unhealthy way or to commit 'food sins'."
14	v_12_fast	Statement: "On vacation, eating fast food (e.g. French fries, burgers, or schnitzel) is essential for me to enjoy myself."
15	v_13_vollAusw	Statement: "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."
16	v_14_Gesch	Statement: "On vacation, I like to enjoy food and drinks that are tasty and filling. All other food qualities play a secondary role."
17	v_15_alacarte	Statement: "On vacation, I prefer à la carte orders to buffets."
18	v_16_Portgr	Statement: "On vacation, I prefer a decent meal regardless of any leftovers."
19	v_17_sozStand	Statement: "Travel companies should not only meet but exceed social standards (i.e. working conditions for employees) even if the price increases for me."
20	v_18_ökStand	Statement: "Travel companies should not only meet but exceed ecological standards (i.e. responsible waste- and sewage handling) even if the price increases for me."
21	v_19_Info	Statement: "Before the start of a journey, travel companies should provide detailed information about the range of food and drinks."

22	v_20_Kennz	Statement: “Hotels or cruise lines that offer sustainable food should be marked accordingly in travel catalogues or online.”
23	v_21_frisch	Statement: “On vacation, freshly-prepared food without any convenience products is important to me.”
24	v_22_Abfall	Statement: “To reduce scraps, smaller portions can be offered on vacations.”
25	v_41_Rzweck_1	Purpose of travel: Beach holidays
26	v_41_Rzweck_2	Purpose of travel: Sport holidays: Skiing, sailing, general summer- or winter sports
27	v_41_Rzweck_3	Purpose of travel: Relaxation, going for a walk, enjoying landscapes
28	v_41_Rzweck_4	Purpose of travel: Health- and wellness holidays
29	v_41_Rzweck_5	Purpose of travel: Visits of friends and/or relatives
30	v_41_Rzweck_6	Purpose of travel: Culture and sightseeing, city trip
31	v_41_Rzweck_7	Purpose of travel: Shopping
32	v_41_Rzweck_8	Purpose of travel: Event, festival
33	v_41_Rzweck_9	Purpose of travel: Official/business trip
34	v_41_Rzweck_10	Purpose of travel: Other holidays
35	v_41_Rzweck_11	Purpose of travel: Cruise
36	v_41_Rzweck_12	Purpose of travel: Experiencing the country and its people
37	v_42_RKat	Travel category
38	v_43_RLand_other	Other destination
39	v_43_RLand_5	Not applicable (e.g. cruise)
40	v_43_RLand_49	Germany
41	v_43_RLand_71	Greece
42	v_43_RLand_92	Italy
43	v_43_RLand_199	Spain and Islands (Canaries, Balearic Islands)
44	v_43_RLand_228	Turkey
45	v_43_RLand_240	United Arab Emirates
46	v_43_RLand_241	USA
47	v_43_RLand_249	Austria
48	v_44a_RAllein	Travel companionship: Alone
49	v_44b_RPartner	Travel companionship: With my partner
50	v_44c_RKind	Travel companionship: With children under 15
51	v_44d_RFam	Travel companionship: With other family members
52	v_44e_RFreu	Travel companionship: With friends
53	v_44f_Rand	Travel companionship: With other persons
54	v_45_Verpf	Type of board
55	v_46_Übern	No. of nights
56	v_51a_frisch	Day-to-day food purchase behaviour: fresh produce
57	v_51b_günst	Day-to-day food purchase behaviour: low price
58	v_51c_sais	Day-to-day food purchase behaviour: seasonal products
59	v_51d_gen	Day-to-day food purchase behaviour: genetically unmodified products
60	v_51e_artger	Day-to-day food purchase behaviour: animal welfare products

61	v_51f_reg	Day-to-day food purchase behaviour: regional products
62	v_51g_zusatz	Day-to-day food purchase behaviour: no artificial additives
63	v_51h_Verp	Day-to-day food purchase behaviour: convenient packaging
64	v_51i_natur	Day-to-day food purchase behaviour: natural products
65	v_51j_Marke	Day-to-day food purchase behaviour: known food brands
66	v_51k_Zuck	Day-to-day food purchase behaviour: foods with little sugar
67	v_51l_Verp	Day-to-day food purchase behaviour: environmental friendly packaging
68	v_51m_bio	Day-to-day food purchase behaviour: organic products
69	v_51n_fair	Day-to-day food purchase behaviour: fair trade products
70	v_51o_allerg	Day-to-day food purchase behaviour: suitable for allergic persons
71	v_51p_Herst	Day-to-day food purchase behaviour: producer act environmentally friendly, social
72	v_61_alt	Age
73	v_62_sex_1	Gender: male
74	v_62_sex_2	Gender: female
75	v_63_Wsitzl_other	Place of residence: other
76	v_63_Wsitzl_49	Place of residence: Germany
77	v_63_Wsitzl_249	Place of residence: Austria
78	v_64_Ausb	Education
Dep. Var.	Sustainable.Product.Choice	Ranking the most sustainable product highest (yes/no)

APPENDIX 7.2.3: R OUTPUT SVM MODEL

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> fitmodel
An object of class "model"
Slot "formula":
Sustainable.Product.Choice ~ .
Slot "model":
[1] "ksvm"
Slot "task":
[1] "class"
Slot "mpar":
$kernel
[1] "rbfdot"
$C
[1] 1
Slot "attributes":
[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
[46] 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79
Slot "scale":
[1] "default"
Slot "transform":
[1] "none"
Slot "created":
[1] "2019-02-05 12:46:25"
R Console Page 5
Slot "time":
elapsed
4.05
Slot "object":
Support Vector Machine object of class "ksvm"
SV type: C-svc (classification)
parameter : cost C = 1
Gaussian Radial Basis kernel function.
Hyperparameter : sigma = 0.00825492907323319
Number of Support Vectors : 2588
Objective Function Value : -1835.976
Training error : 0.110727
Slot "outindex":
[1] 79
Slot "levels":
[1] "0" "1"

```

APPENDIX 7.2.4: R OUTPUT LOGIT MODEL

```

> summary(Log.Model)
Call:
glm(formula = Sustainable.Product.Choice ~ ., family = binomial((link = "logit")),
     data = Sus.Food.Train.Smote)
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.67876 -0.67019  0.04103  0.66475  2.89416
Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)  -5.333e+00  7.531e-01 -7.082 1.42e-12 ***
v_1_ErnV_1   -4.661e-01  7.161e-01 -0.651 0.515119
v_1_ErnV_2   -3.972e-01  3.432e-01 -1.157 0.247116
v_1_ErnV_4   -2.571e-01  2.251e-01 -1.142 0.253457
v_3_Lmreg    4.113e-01  2.660e-01  1.547 0.121959
v_4_Fair     -2.232e-01  2.784e-01 -0.802 0.422653
v_5_Bio      2.209e+00  2.799e-01  7.894 2.94e-15 ***
v_6_Fleisch  -6.902e-01  2.075e-01 -3.326 0.000881 ***
v_7_Inh.Nähr 3.210e-01  2.286e-01  1.404 0.160171
v_8_landtyp  7.685e-01  2.839e-01  2.707 0.006796 **
v_9_herk     3.001e-01  2.402e-01  1.249 0.211579
v_10_Kultur  -1.134e-01  3.228e-01 -0.351 0.725372
v_11_unges   5.233e-01  1.980e-01  2.644 0.008204 **
v_12_fast    3.053e-01  2.169e-01  1.408 0.159183
v_13_vollAusw 1.642e+00  2.051e-01  8.005 1.19e-15 ***
v_14_Gesch  -1.855e-01  1.748e-01 -1.061 0.288850
v_15_alacarte -9.351e-02  1.690e-01 -0.553 0.580124
v_16_Portgr  9.337e-01  2.918e-01  3.200 0.001374 **
v_17_sozStand 6.763e-01  3.134e-01  2.158 0.030939 *
v_18_ökStand 9.617e-01  3.178e-01  3.026 0.002476 **
v_19_Info    2.685e-01  1.856e-01  1.447 0.147841
v_20_Kennz   -5.627e-01  2.381e-01 -2.364 0.018092 *
v_21_frisch  -1.982e-01  3.621e-01 -0.547 0.584086
v_22_Abfall  5.032e-01  2.575e-01  1.954 0.050697 .
v_41_Rzweck_1 -2.521e-01  1.953e-01 -1.290 0.196908
v_41_Rzweck_2 2.111e+00  4.003e-01  5.275 1.33e-07 ***
v_41_Rzweck_3 5.885e-02  2.023e-01  0.291 0.771131
v_41_Rzweck_4 -3.027e-01  5.059e-01 -0.598 0.549660
v_41_Rzweck_5 6.901e-02  5.315e-01  0.130 0.896692
v_41_Rzweck_6 -5.302e-01  2.805e-01 -1.890 0.058720 .
v_41_Rzweck_7 -1.210e+01  2.621e+02 -0.046 0.963165
v_41_Rzweck_8 -8.109e-01  8.772e-01 -0.924 0.355286
v_41_Rzweck_9 -8.689e-01  1.445e+00 -0.601 0.547617
v_41_Rzweck_12 3.016e-01  2.344e-01  1.287 0.198150
v_42_RKat    6.389e-02  3.351e-01  0.191 0.848808

```

```

v_43_RLand_other -3.946e-01 1.513e-01 -2.608 0.009103 **
v_43_RLand_49 -4.852e-01 2.549e-01 -1.904 0.056970 .
v_43_RLand_71 1.587e-02 3.234e-01 0.049 0.960855
v_43_RLand_92 -9.264e-01 2.728e-01 -3.396 0.000684 ***
v_43_RLand_199 -3.195e-01 1.823e-01 -1.752 0.079785 .
v_43_RLand_228 6.944e-01 2.999e-01 2.316 0.020564 *
v_43_RLand_240 3.939e-01 3.270e-01 1.205 0.228326
v_43_RLand_241 8.221e-01 2.510e-01 3.276 0.001054 **
v_43_RLand_249 -1.015e+00 4.072e-01 -2.494 0.012643 *
v_44a_RAllein -2.109e-01 3.412e-01 -0.618 0.536419
v_44b_RPartner -7.278e-01 2.564e-01 -2.838 0.004541 **
v_44c_RKind -1.204e-01 2.014e-01 -0.598 0.549828
v_44d_RFam -6.465e-01 2.889e-01 -2.238 0.025241 *
v_44e_RFreu -1.287e+00 2.443e-01 -5.268 1.38e-07 ***
v_44f_Rand -4.788e-01 3.078e-01 -1.555 0.119847
v_45_Verpf -8.723e-01 2.996e-01 -2.911 0.003601 **
v_51a_frisch 3.423e-01 1.476e-01 2.319 0.020375 *
v_51b_günst -5.330e-01 1.040e-01 -5.123 3.00e-07 ***
v_51c_sais -1.462e-01 1.057e-01 -1.384 0.166377
v_51d_gen 2.548e-01 1.006e-01 2.533 0.011319 *
v_51e_artger 4.473e-01 1.007e-01 4.439 9.02e-06 ***
v_51f_reg -3.946e-04 1.335e-01 -0.003 0.997642
v_51g_zusatz -1.403e-01 1.036e-01 -1.354 0.175646
v_51h_Verp -2.245e-01 1.713e-01 -1.311 0.189820
v_51i_natur 2.262e-01 1.048e-01 2.159 0.030815 *
v_51j_Marke -4.331e-01 1.197e-01 -3.617 0.000298 ***
v_51k_Zuck 2.098e-01 9.777e-02 2.145 0.031923 *
v_51l_Verp -3.432e-02 1.151e-01 -0.298 0.765534
v_51m_bio 9.675e-01 1.048e-01 9.231 < 2e-16 ***
v_51n_fair 3.457e-02 1.092e-01 0.317 0.751560
v_51o_allerg 3.833e-01 1.762e-01 2.175 0.029664 *
v_51p_Herst -2.693e-02 1.218e-01 -0.221 0.825015
v_61_alt 2.402e+00 4.190e-01 5.733 9.85e-09 ***
v_62_sex_2 -1.485e-01 9.734e-02 -1.525 0.127182
v_63_Wsitzl_49 -5.560e-01 3.378e-01 -1.646 0.099808 .
v_63_Wsitzl_249 -7.461e-01 4.575e-01 -1.631 0.102897
v_64_Ausb -7.513e-01 2.115e-01 -3.553 0.000382 ***

```

```

---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for binomial family taken to be 1)
Null deviance: 5797.5 on 4181 degrees of freedom
Residual deviance: 3672.6 on 4110 degrees of freedom
AIC: 3816.6
Number of Fisher Scoring iterations: 12

```


7.3 Study III: Food Waste in Hotels - Can Direct Communication at the Point of Consumption Reduce the Attitude-Behaviour Gap?

Abstract:

Food waste produced by consumers causes severe environmental, ethical, and social problems. Therefore, initiatives that try to change consumer behaviour are of increasing importance. In the context of travel, however, it is known that an attitude-behaviour gap regarding sustainability issues, such as food waste, often prevails. This study examines whether this gap can be overcome through the use of communication tools conveying information on the issue of food waste in an all-you-can-eat buffet restaurant of a typical sun-and-beach tourist hotel. Building on Stern's Attitude-Behaviour-Context theory, the study uses a quasi-experimental design to test the impact of communication tools using an informational prompt as a stimulus for inducing sustainable guest behaviour in a hedonic context that generally discourages sustainability. The results proved the effectiveness of the communication tools, represented in a reduction in food waste of 14.4%. A possible explanation is that the stimulus was successful in activating latent sustainable consumer attitudes which then outweighed the motivation for overconsumption stemming from the all-you-can-eat context. Hotels should therefore more actively integrate their guests into the handling of societal sustainability challenges. They can furthermore directly benefit from the results by saving on food resources through a cost-effective measure.

Keywords: consumer behaviour, sustainability communication, field experiment

Introduction

About 20% to 60% of all food purchased by the hotel and restaurant industry is wasted (Lund-Durlacher, Fritz, & Antonschmidt, 2016). This not only represents poor cost management by hotels and gastronomy businesses, but is also highly questionable from an ethical and social point of view considering there are almost one billion malnourished people in the world (UN, 2017). Furthermore, food waste needlessly consumes natural resources such as land and water, and generates unnecessary emissions of CO₂ (created in production processes) and methane gas (given off by food decomposition in landfill) which contribute greatly to climate change (Gössling & Peeters, 2015; Lund-Durlacher et al., 2016; Juvan, Grün, & Dolnicar, 2018). Reducing food waste would significantly mitigate these negative environmental impacts. Food waste in hotel food operations mainly arises during meal preparation (around 30%), from the presentation at buffets (around 20%), as well as from guests' plate waste (around 20%) (United Against Waste, 2016). Besides waste reduction measures taken by the hotel management and staff during food storage, production and presentation, guests have a key role to play in reducing food waste by considerate food consumption and by reducing edible plate waste. While a survey by Lund-Durlacher et al. (2016) finds that tourists generally state that they value a more sustainable food offer and are willing to contribute to food waste reduction, field visits within the same study show that actual tourist food consumption behaviour remains largely unsustainable. This attitude-behaviour gap has already been confirmed by several earlier studies on pro-environmental behaviour in tourism (e.g. Juvan & Dolnicar, 2014; Dolnicar, Knezevic Cvelbar, & Grün, 2017, Miao & Wei, 2013). Widening the attitude-behaviour gap is a social desirability bias that lowers the validity of self-reported environmentally sustainable tourist behaviour measures (Juvan & Dolnicar, 2016).

In light of the negative environmental impact of food waste, the important role of hotel guests in reducing food waste, and the existence of an attitude-behaviour gap on the part of guests, the current study makes the following two key contributions: (1) The first, practice-oriented aim was to test the effects of direct communication tools on the food waste behaviour of hotel guests. This component explores how consumers react to food waste information in a hedonic travel context and whether they change their behaviour regarding food waste accordingly. (2) As not all communication tools show the same level of impact, the second aim of the study was to identify the most effective positioning for direct communication tools to influence guest behaviour. In line with its intended contributions, the following research questions for this study are deducted:

RQ 1: *Does the use of communication tools promoting 'waste prevention' to hotel guests reduce the amount of edible plate waste?*

RQ 2: *Which of the communication tools promoting ‘waste prevention’ to influence guest behaviour are the most effective?*

Building on Stern’s Attitude-Behaviour-Context (ABC) theory, a third, theory-oriented aim was to validate the hypothesis of context dependency of behavioural change towards sustainability, taking a sun-and-beach tourism hotel as an example. This hypothesis is based on research by Dolnicar et al. (2017, p.8) who conclude that the “effectiveness of pro-environmental appeals in triggering pro-environmental behaviour is context dependent” and that consequently “pro-environmental appeals are ineffective in hedonic contexts”. In this study, it is argued that the appeals’ effectiveness might vary with their positioning since this influences the guest perception. Effective positioning recognizes guest convenience and the minimization of consumer costs as major requirements for nudges in a hedonic context (Hansen & Maaloe Jespersen, 2013). On the practical side, it saves resources for the implementing hotel. Accordingly, the following hypotheses are formulated:

H1: *Distinctively positioned pro-sustainability communication tools can activate pro-sustainability attitudes on the part of consumers.*

H2: *Activated pro-sustainability attitudes on the part of consumers can overcome the restraining effect of hedonic contexts for behavioural change.*

In line with the research questions and H I/H II, this study aims to evaluate the suitability of different communication tools positioned at different contact points as a stimulus for activating pro-sustainability attitudes in tourists, with the intention of overcoming the attitude-behaviour gap through a real-life experiment. It explores whether consumers change their food consumption behaviour as a reaction to the stimulus, and furthermore measures the familiarization of guests with the communication tools as a proxy for their effectiveness in motivating behavioural change. The study employs a quasi-experimental design supported by a guest survey to identify cause-effect relationships between the use of the tools and guest behaviour. It indicates whether consumers are willing to change towards more sustainable practices, even if they affect central pleasure-related travel components such as food.

Literature Review

Green Consumption

Green consumption and the green consumer have been gaining increasing attention from marketing research at least since the 1990s. In an early characterization, Roberts (1996, p. 222) defines ecologically conscious consumers “as those who purchase products and services which they perceive to have a positive (or less negative) impact on the environment”. Increasingly, consumers also take social considerations

into account, so that the marketplace acts as a forum wherein they articulate socio-political convictions and press for political change (Watkins, Aitken, & Mather, 2015; Hüttel, Zieseimer, Peyer, & Balderjahn, 2017). This type of consumer is also referred to as the ‘citizen consumer’ (Spaargaren, 2003), who, as a power agent, is assigned responsibility for the governance of increasingly supranational sustainability problems (Barr, Gilg, & Shaw, 2011; Ehrgartner, 2018).

Nevertheless, consumers are not a homogeneous group with respect to sustainability. Balderjahn, Peyer, Seegebarth, Wiedmann, and Weber (2018) differentiate six groups of consumers according to their sustainability consciousness. With the exception of one segment, the connection between value orientation, socio-demographics, and sustainable consumption behaviour is ambiguous; e.g., people who express little concern for sustainability may nonetheless buy sustainable products. Furthermore, buying behaviour differs among product categories; i.e., different modes of consumption coexist within the same consumer group.

The trend towards sustainable consumption is also increasingly affecting the area of food, especially since food is an ethically sensitive consumer good, and the connection between food and natural resources is much more directly visible in comparison to other consumer products (Reisch, Eberle, & Lorek, 2013). Verain, Dagevos, and Antonides (2015), using a sample of Dutch adult consumers representative for gender and age, differentiate four consumer types using the following segmentation variables: food choice motives, personal norms, social norms, food involvement, subjective knowledge with respect to sustainable food, ability to evaluate how sustainable a product is produced, and sociodemographics. Three of these consumer types, which account for just under two thirds of respondents, show a sustainability orientation, either displayed through curtailment of unsustainable foods or through the increased consumption of more sustainable products. Vanhonacker, Van Loo, Gellynck, and Verbeke (2013), using a non-representative convenience sample, assess the meat consumption behaviour of Belgian consumers and differentiate five segments according to consumers’ awareness of climate change related problems, and willingness to change consumption decisions. While four segments are aware of the environmental consequences of their consumption decisions, three of these segments do not show a willingness to adapt their consumption behaviour.

In the tourism context, a study about “Sustainable Food in the Holiday Context” shows that, based on an online survey with package tourists ($n = 7,915$), there are favourable attitudes towards sustainable food prevailing (*removed for review purposes*). Of particular interest is that a majority of guests is willing to accept smaller portion sizes if this helps to prevent food waste. Nonetheless, the adoption of sustainable food management practices by holiday hotels remains low (*removed for review purposes*).

One reason for this low adoption on the part of hotels could be that the real attitude of guests is not necessarily considered as being pro-environmental by hoteliers, who therefore do not adapt the context accordingly (Alonso-Almeida, Fernandez-Robin, Celemín Pedroche, & Santander Astorga, 2016; Bohdanowicz, 2005; Melissen, Cavagnaro, Damen, & Düweke, 2016). Another reason is the prevalence of the addressed attitude-behaviour gap. This could be due to the tourism hotel environment, since this context differs from regular purchase situations in multiple respects. Tourism hotels can be considered a hedonic context in which individual enjoyment and the maximization of individual benefits at minimal individual costs are major aims (Dolnicar et al., 2017). Providers react to this hedonic motive by offering unrestricted consumption opportunities in their hotels. Unrestricted food consumption in particular is offered since food is categorized as one of the major pleasure components of a trip (McKercher, 2016). In these all-you-can-eat situations, the guests are not restricted in their consumption by any short-term, direct costs. Such unrestricted conditions often lead to unsustainable overconsumption tendencies (Woosnam & Erul, 2016; Farmaki, Georgiou, & Christou, 2017). In line with hypothesis I, the attitude-behaviour-context (ABC) theory states that in contexts that make the behavioural change extremely difficult or extremely easy, the activation of attitudes is not sufficient to change behaviour (Guagnano, Stern, & Dietz, 1995). However, due to a lack of experimental studies, it still remains unclear if an all-you-can-eat buffet restaurant in a sun-and-beach tourist hotel can be considered such an extreme context as defined by the ABC theory.

Information and Communication Strategies

To encourage consumers to ‘deviate’ from their usual, rational conduct requires intelligent communication techniques. Hotels often employ so-called nudging techniques to influence guests’ food consumption and to reduce edible plate waste, which describes food which is taken on the plate or served, but not eaten (Kuo & 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 for preventing food waste in hotels include offering smaller and single portions, using smaller serving dishes and plates, as well as live-cooking stations (Lund-Durlacher et al., 2016). Another popular nudging strategy is to provide sustainability information to hotel guests. Lee and Oh (2014) differentiate four main parameters to be manipulated for the communication of sustainability information: frame, regulatory focus, construal level, and relevance. The frame refers to the tone (positive or negative) with which the sustainability information is communicated. An example would be stressing the positive impact of resource saving against the negative impact if resources are *not* saved.

The regulatory focus can be divided into the achievement of higher sustainability goals versus the prevention of negative impacts of unsustainable behaviour. The construal level refers to the psychological level of communication which can be abstract or concrete and action-oriented. The parameter relevance can vary between individual- and society-orientation; i.e., the communication message can stress the individual or the societal benefits of sustainable behaviour.

Factors influencing Attitudes and Behaviour with respect to Sustainable Consumption

Vermeir and Verbeke (2006) find that involvement with sustainability, certainty (through information and knowledge), perceived behavioural control, social norms, and perceived availability positively influence attitudes to buy sustainable products. Kumar, Manrai, and Manrai (2017) show that environmental knowledge and attitude have a major influence on purchase intention, while subjective norm has no direct effect on purchase intention, and even moderates the relationship between environmental knowledge and attitude negatively. Joshi and Rahman (2017) find the factors ‘supportive behaviour for environmental organisations’, ‘subjective norms’, i.e. expectations of friends, relatives or the wider society, ‘attitudes towards sustainable purchasing’, ‘perceived marketplace influence’, ‘perceived knowledge regarding sustainability issues’, and ‘environmental concern’ to have a significant positive influence on sustainable purchase behaviour. Addressing consumer food waste behaviour, Stancu, Haugaard, and Lähteenmäki (2016) find that attitudes towards waste prevention, injunctive norm (norm set by the behaviour of others), and perceived behavioural control (past behaviour, perceived barriers, and facilitators) have a positive influence on the intention not to waste food as well as the actual amount of food waste that consumers produce.

Interventions to reduce Food Waste

Cioffi, Levitsky, Pacanowski, and Bertz (2015) show that through the provision of nutrition information on pre-packaged food in the university dining facilities of a US university, the purchase of high-calorie and high-fat foods was reduced, while the consumption of low-calorie and low-fat foods was increased. The authors use a quasi-experimental design whereby sales data is collected for three consecutive semesters before and after the labels were added. Mixed models are used to check for the significance of any changes. It is found that the mean energy-content of food sold after the labels were introduced was 6.5% lower, while the fat-content was 7.4% lower. Respectively, sales of low-calorie food items increased from 2.9 to 3.2% of purchases, while high-fat food items reduced from 2.9 to 2.6%. All changes were significant at the 0.1%-level.

Kallbekken and Saelen (2013), apply signage promoting the ‘correct’ self-service behaviour in restaurants using a sample of 52 Scandinavian hotels, next to a variation of plate sizes. Their signage, placed at the

buffet, uses a direct social cue (“Welcome back! Again! And again! Visit our buffet many times. That’s better than taking a lot once.”). The experiment is implemented over a period of ten weeks in seven hotels for each condition, while the remaining 38 hotels serve as the control group. The data are analyzed with a difference-in-difference model using a fixed effects panel regression with amount of food waste as the dependent variable. As a result, a reduction of food waste by 20.5%, significant at the 0.1% level, is measured.

Stöckli, Dorn, and Liechti (2018) test the effect of place cards with informational (“One third of food is wasted. [...]”), and normative and informational prompts (“Our guests expect a reduction in food waste. One third of food is wasted. [...]”) on the frequency of taking away food leftovers in a Swiss pizza restaurant. The interventions are tested over a period of six weeks, and a control condition is kept over the same time frame. The post hoc analysis revealed a significant effect of both the informational, and normative and informational prompt on the frequency of taking away leftovers. While in the control condition, only 25% of diners are willing to take away leftovers, this percentage rises to 55% for the informational condition and to 64% for the informational and normative condition, respectively ($p = 0.048$). However, the authors find no significant difference between the two manipulations ($p = 0.59$).

Whitehair, Shanklin, and Brannon (2013) using a US university dining facility as experimental site, test the effect of an informational message (“All Taste... NO WASTE. EAT WHAT YOU TAKE. DON’T WASTE FOOD.”), and an information 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.”) on the amount of edible plate waste produced by 296 university students. The six-week study was divided into a two-week baseline measurement, followed by a two-week bloc in which the informational message was tested, and a two-week bloc in which the feedback-based message was tested. Furthermore, the authors measured the students’ attitude towards sustainability and food waste with a written questionnaire. They find a reduction in food waste by 15% as a result of using the informational message ($p < 0.05$), while the adding of the feedback-based message did not lead to any additional significant reduction in food waste. Furthermore, the positive attitudes students held towards sustainability and food waste did not change significantly during the whole test phase. Based on these findings, the authors conclude that information reminding students of their prevailing positive attitudes is effective in stimulating a behavioural change.

While the reviewed studies test the effectiveness of food signage in different restaurant contexts, experimental studies in sun-and-beach tourism hotels are rare. At the same time, the growing emergence of sustainability considerations, especially in mass tourism, calls for more studies specific to this context. This becomes even more important since mass tourism possesses several food-related particularities, such as a tendency towards overconsumption, and a trend towards standardization and commodification

of the food offer (Richards, 2002; Urry, 1990; Koc, 2013; Koc, 2016). Therefore, this study closes a prevailing significant and important research gap by testing the effect of using food communication tools in a mass tourism hotel context.

Development of Theoretical Construct

A possible explanation for the attitude-behaviour gap in tourism is that attitude is just one of several predictors of behaviour. Indeed, behaviourist theories differentiate a multitude of other influential factors. One important theory which has broadened the scope of observed factors is the attitude-behaviour-context (ABC) theory (Stern, 2000). This theory states that the interplay of attitudinal and context variables determines individual behaviour. Attitudes thereby constitute the positive or negative intrinsic positions an individual holds towards a behaviour. The context, in turn, includes any influences external to the individual mind which could support or inhibit behaviour such as economic costs and benefits, behaviour of other people, cultural expectations etc. (Guagnano et al., 1995). The ABC theory is an extension of the norm activation theory by Schwartz (1977) which states that altruistic behaviour is the consequence of the feeling of moral obligation, which in turn is caused by the activation of an individual's cognitive structure of norms and values and the absence of defences against this obligation. While prevailing attitudes are difficult to change in the short term, they can be directly activated through external stimuli. This study therefore builds on the ABC theory and tests the impact of an external stimulus on the activation of pro-sustainability attitudes in a hedonic tourist hotel context. In particular, it is to be tested if this activation of attitudes is a sufficient condition for pro-sustainability behaviour.

Insert Fig. 7.3.1

Methodology

The main aim of this study is to identify a causal relationship between the usage of different types of sustainability communication tools and guest behaviour. Furthermore, the hypothesis of context dependency of behavioural change is to be tested. In line with these aims, an experimental design in a real-life context was chosen as the appropriate method of investigation. Experimental designs allow the unambiguous identification of cause-effect relationships since confounding factors can be controlled in the experimental setting. Furthermore, they use actual behaviour as the variable to be influenced instead of, e.g., survey designs which use virtual, non-consequential choices as a proxy for real-world behaviour. Experimental designs are therefore less prone to social desirability bias. This is of great importance for this study, since social desirability bias is known to be one of the main factors responsible for the attitude-behaviour-gap phenomenon.

In classical experimental designs, the sample is randomly split into two groups under the assumption that any confounding factors are equally distributed among the two groups so that they equally influence the test results. Usually, only one factor is manipulated in the test group while the control group remains unmanipulated. This allows for the unambiguous identification of cause-effect relationships. However, in this study, an experimental design was not applicable since the hotel guests could not be randomly assigned to test and control groups. To still benefit from the advantages of an experimental design even without randomly split groups, a quasi-experimental design was chosen instead. This type of approach does not randomly split groups, but still tries to choose groups that are as homogeneous as possible with respect to potentially confounding variables.

As an experimental approach, a ‘post test-only design’ with non-equivalent groups was chosen (Shadish, Cook, & Campbell, 2002). This type of design measures the variable in question only once for each experimental condition. The results for each group are compared afterwards. For this study, the data collection phase was divided into a baseline (control) phase and a test phase. To adjust for the non-random assignment to experimental groups, data collection period and hotel were selected in a way that the guest clientele was as homogenous as possible with respect to different socio-demographic and other characteristics (age, country of origin, education, gender, size of the travel party, type of board). Nonetheless, the data of the travellers was matched between the baseline and test phase (Shadish et al., 2002).

Despite the advantages of a quasi-experimental design, not all potentially confounding influences can be measured with such an approach. Implicit values in particular are not directly observable, and therefore their influence cannot be assessed via an experiment. For this study, this applies mainly to attitudes of guests towards sustainability. Nonetheless, in line with the ABC theory, attitudes can have a significant impact on the experimental results. To overcome this potential validity threat, guest surveys after both baseline and control phases measured attitudes and other potentially confounding influences. Furthermore, the food consumption behaviour of guests was measured to rule out that a potential change in food waste was caused only by a general change in food consumption in the test phase. The second purpose of the survey was related to RQ2 and measured the extent to which the guests familiarized themselves with the communication tools at the different contact points. Again, this variable would be difficult to assess via an experiment.

Procedure of the Study

The procedure of the study can be structured along the following consecutive phases:

1. Development of the communication tools
2. Pretesting of the tools and manipulation check
3. Data collection in the test hotel

The whole study had a duration of around 12 months.

Development of the Communication Tools

The factors to influence sustainable consumption decisions as identified from the literature review informed the development of the communication tools. The final communication tools state which measures the hotel undertakes to prevent food waste, outlines what the guests can do to prevent food waste, provides factual information on the issue of food waste, and directly instructs consumers to not waste food. Linked to the identified influential factors, the communication tools impose a social norm, increase the knowledge of consumers, and inform them about their marketplace influence. The communication messages were concrete and action-oriented, and held in a positive tone. The prevention of negative impact was in the focus, and the accentuation was on the societal benefits of food waste prevention. While the tools intended for the restaurant entrance and the guest tables addressed the factors ‘imposition of social norms’, ‘increase in perceived marketplace influence’, and ‘increase of knowledge on sustainability issues’, the tool at the plate issuance – due to space limitations – addressed only the factors ‘imposition of social norms’ and ‘increase in perceived marketplace influence’. An overview of the final tools can be found in Appendix 7.3.1.

Pretesting of the Tools & Manipulation Check

The different communication tools and their messages were pretested in a tourist hotel in Austria, and guest feedback was collected to inform their further adaptation. A key result of the guest feedback was that the positioning of the communication tools had a major impact on their recognition by the guests. The most effective contact points as measured by guest recognition were the buffet and the guest table.

An information designer subsequently developed the final tools. The tools have a standard layout which makes them transferable to different hotel contexts. Furthermore, they were translated into three languages (English, German, Spanish) to ensure that the majority of guests in the test hotel could understand the messages.

To verify if the tools transported the intended message, a manipulation check was conducted with 25 university students. The participants were shown the tools, and afterwards they were asked to state which message they thought the tools would transport. The results indicate that the participants’ perception of the messages was congruent with their intent.

Insert Tab. 7.3.1

Insert Appendix 7.3.1

Data Collection in the Test Hotel

The data collection took place during normal hotel operations over a period of three weeks (9 July to 29 July 2017). Before the data collection phase, a briefing was held with the hotel staff on the correct collection of the edible plate waste and the correct positioning of the communication tools.

The test hotel was a typical sun-and-beach tourist hotel located in Maspalomas, on the island of Gran Canaria (Spain). Tab. 7.3.2 gives an overview of its characteristics and its guest profile. All hotel 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 to be consumed for all board types. The guests collected their plates at the beginning of the buffet and then walked around the serving stations. The food availability was unlimited during the breakfast period from 07:30 to 10:30am. The food offer included hot and cold international dishes, e.g. scrambled eggs, cheese and sausage platters, fruits, and cereals. In line with the results of the pretest, the communication tools were installed at the buffet and at the guest tables. Additionally, one communication tool was placed at the entrance to the restaurant as this is a contact point already frequently used by restaurants to communicate e.g. special offers. Therefore, it was assumed that hotel guests are receptive for food-related information at this particular contact point. Each contact point was supplied with one communication tool. Fig. 7.3.2 provides an overview of the experimental lay-out. The edible plate waste was collected separately by waiters with cleaning carts during the breakfast period. Afterwards, the waste was pooled in a huge container and weighted with an industrial scale.

Insert Tab. 7.3.2***Insert Fig. 7.3.2***

The baseline phase and the test phase lasted for seven days each. In the baseline phase, no communication tools were applied, and the total amount of edible plate waste was collected. After the baseline phase, a one-week break was kept to allow for guest rotation and to ensure the independence of the observations. In the consecutive test week, the communication tools were positioned at the three contact points. Again, the edible plate waste was collected. In both phases, further variables such as nationalities of guests, type of board, price level of the hotel, and the number of guests were collected since they represent important covariates.

Insert Tab. 7.3.3***Insert Tab. 7.3.4***

After both *ex ante* and *ex post* phases, the guest surveys were conducted. The guests were issued a paper questionnaire at the last day of each data collection phase. They were approached when leaving the restaurant after breakfast to eliminate a potential bias. The *ex ante* questionnaire used three to seven-point scales to assess the attitude of tourists towards sustainable food, the food consumption behaviour of guests, and sociodemographic and other guest data such as average number of days already spent in the hotel, age, gender, country of origin, average party size, and education. The *ex post* questionnaire was identical to the *ex ante* questionnaire, but additionally asked for the extent to which the guests familiarised themselves with the single communication tools using a four-point scale.

The attitudes of guests towards sustainable food were assessed by using a multidimensional measurement scale consisting of 20 items developed by *removed for review purposes*. Although the survey participants were comparable along sociodemographic data, in line with the quasi-experimental design, they were not identical between baseline and test phase. An overview of the survey participants' characteristics can be found in Appendix 7.3.2.

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 control for changes in potentially confounding covariates.

Analysis of Context Covariates

The guest data available from the hotel was compared between baseline and test phase to identify significant differences. Of particular interest was the guests' country of origin since Juvan, Grün, and Dolnicar (2018) find a significant impact of guest nationality on food waste behaviour. The only significant difference of this covariate concerned the percentage of Dutch guests which was significantly higher in the test phase. However, no evidence was found in Juvan et al. (2018) that this group wastes particularly little food. Therefore, it is concluded that the change did not significantly impact the test result. Other covariates such as mixture of board arrangements, number of buffets, and guest presence did not differ between baseline and test phase.

Analysis of Survey Covariates

One significant difference between baseline and test phase concerned the average number of days guests had spent in the hotel until the date of the survey. This variable was therefore included as a covariate for the statistical analysis. Furthermore, the guests reported a higher food consumption in the test phase (Tab. 7.3.6). This makes it likely that the amount of food waste in the test phase was higher compared to the baseline phase.

Insert Tab. 7.3.6

Insert Tab. 7.3.7

There was no considerable change in the positive attitude of guests towards food sustainability. The results show only one significant change (p (1-tailed) < 0.05) concerning the importance of traditional food which was valued higher by participants of the ex post survey.

Findings

After controlling for the influence of the covariates, the data were further analyzed with reference to the research questions and to H I.

Change of Consumption Behaviour

To check for 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 amount of edible plate waste per guest was lower during the test phase (-14.39%). From a Mann-Whitney test, it can be concluded that the difference between the weeks was significant (Tab. 7.3.5). As the guests reported that they consumed significantly more food in the test phase, it can be followed that the relative reduction in food waste was likely to be even higher.

Insert Tab. 7.3.5

Familiarisation with the Communication Instruments

The survey results show that the signage at the restaurant table achieved the highest attention since it was read in detail by a majority of guests. The signage at the restaurant entrance was noticed by most of the guests, but only a minority read it in every detail. The signage at the buffet was noticed by a majority of guests as well, however, also shows a high percentage of guests who did not notice it at all (Tab. 7.3.8).

Insert Tab. 7.3.8

Discussion

The results proved the effectiveness of communication tools for promoting the prevention of food waste to hotel guests in sun-and-beach tourist hotels. An immediate effect on the consumption behaviour of tourists could be found, resulting in less edible plate waste, while the guests' favourable attitude towards sustainable food remained stable over both data collection phases. In line with Whitehair et al. (2013),

under such conditions, the informational prompt from the communication tools proved sufficient to motivate behavioural change towards sustainability. Relating these findings to the propositions of the ABC theory, the results show that, even in a context discouraging sustainable consumption, a well-positioned stimulus that imposes a social norm, increases the perceived marketplace influence, and increases the knowledge on sustainability issues can activate latent positive attitudes towards sustainability. These attitudes then seem to outweigh the restraining effect of the context and consequently lead to a change in consumer behaviour. Since its effect can be outweighed, it can be concluded that the hedonic sun-and-beach tourism hotel context cannot be considered an extreme context as defined by Guagnano et al. (1995). Thus, H I and H II were supported, while Dolnicar et al.'s (2017) conclusion cannot be confirmed.

On the contrary, it could be hypothesized that in the buffet style hotel restaurant context which constitutes a new environment compared to the home context, the tourists might be even more receptive to sustainability information and therefore more likely to change their habitual, potentially unsustainable eating behaviour (van't Riet, Sijtsema, Dagevos, & De Bruijn, 2011). To test this hypothesis, however, the effectiveness of the interventions should be tested in the tourists' home context as well.

Overall, the results provide support for the hypothesis that through direct communication, consumer behaviour can be harmonized with sustainability requirements also in unrestricted consumption contexts if the direct communication is effectively positioned and can build on prevailing positive attitudes towards sustainability. The results furthermore indicate that consumers are willing to act as 'citizen consumers' once they are reminded of their responsibility. This willingness can be used by the hotel industry and policy makers to more actively integrate their guests into the handling of societal sustainability challenges.

Taking a business perspective, it should be noted that while the use of signage did lead to less food waste, it did not encourage tourists to consume less food in general. Therefore, it can be concluded that the signage did not impede the hedonic travel experience of guests. This can be considered an important prerequisite for the success of sustainability interventions in the tourism context. Hotels can furthermore directly benefit from the results by saving on food resources through a cost-effective measure. Communicating their sustainable food policy can also be an effective way for hotels to highlight their corporate social responsibility efforts. In this respect, it is important that the signage at the guest tables received the highest attention. A possible explanation might be that guests have only a limited acceptance for 'non-hedonic' interferences while they are on their way to the restaurant or taking food from the buffet. When they sit at their table, however, they possess sufficient time to read the messages. This result confirms the importance of positioning for the effectiveness of pro-sustainability appeals in hedonic contexts (Hansen & Maaloe Jespersen, 2013). A practical implication of this finding is that cost-conscious hotels could concentrate on the contact point at the guest tables for communicating sustainability information.

Future research should further investigate the impact of social norms, and especially differentiate between descriptive norms, i.e. what the majority of guests does, and injunctive norms, i.e. what the majority of guests disapproves. Furthermore, it could be researched which aspect of the messages was most effective in convincing consumers to change their behaviour. Another interesting manipulation would be to vary the perceived locus of control of guests with respect to sustainability behaviour; i.e., to variate the contextual barriers for acting sustainable. Also, the use of different forms of nudges, e.g. smaller plates, would be a fruitful variation.

Limitations

Since the study aimed to investigate a causal relationship between communication instruments and guest behaviour, it was crucial for ensuring internal validity to control for any other confounding influences. Although an attempt was made to identify all possible influential variables detailed in the literature, there is no absolute assurance that this list is exhaustive. In this regard, the greatest validity threat arises from the quasi-experimental design since although the measured sociodemographic differences between the groups were small, the possibility of an influence of any further unmeasured differences cannot be ruled out. Finally, the generalisability of the findings is limited since the experiment was only conducted in one hotel in one destination. However, Gran Canaria can be considered a typical package holiday destination, and the sample site was a typical sun and beach tourist hotel. Therefore, the findings should be broadly transferable to other mass tourism destinations.

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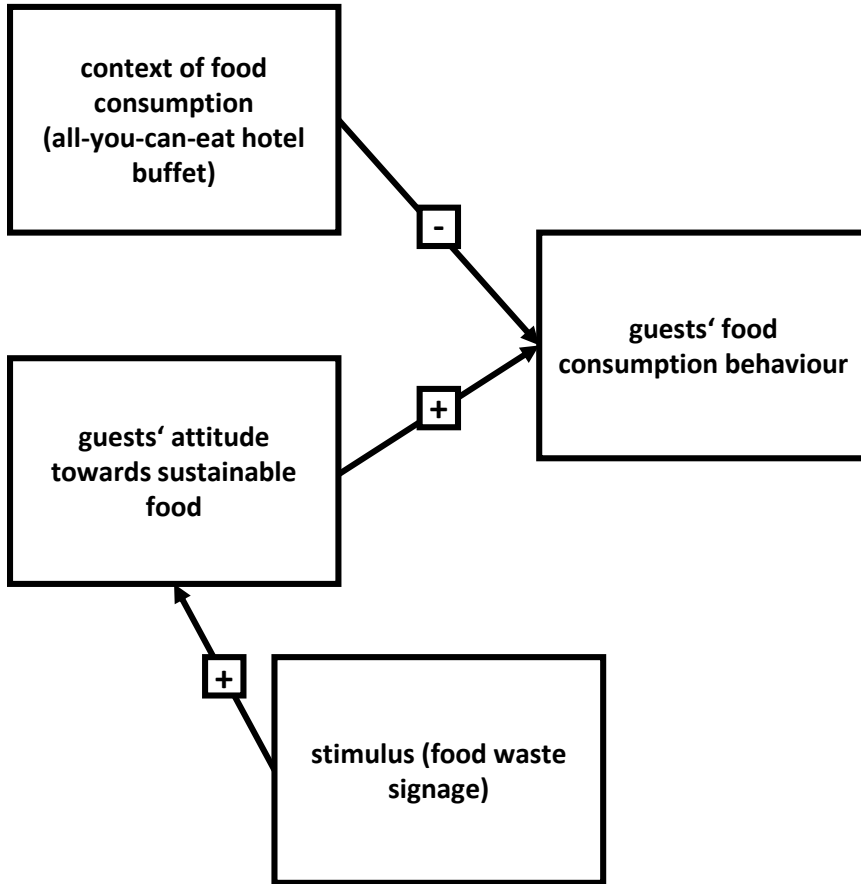
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Tables and Figures from the Text

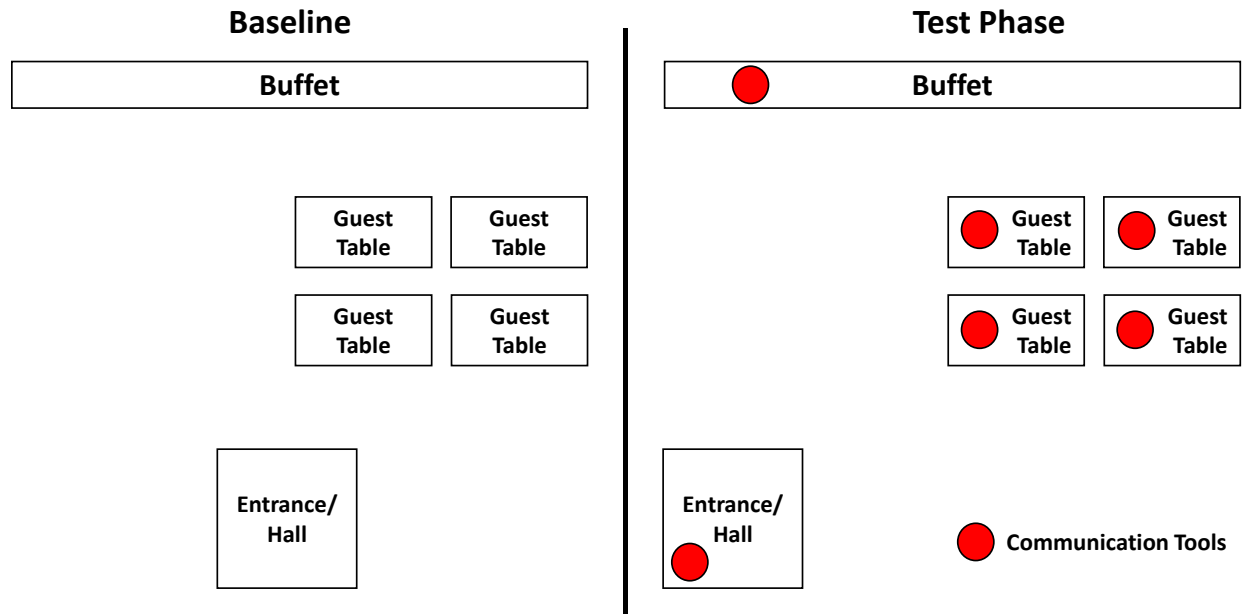
FIG. 7.3.1: THEORETICAL CONSTRUCT



TAB. 7.3.1: RESULTS MANIPULATION CHECK (N = 25)

Instruments	"It is to show what I can do individually to support sustainability efforts."	"It is to inform me that sustainable products are offered."	"It is to highlight the benefits of consuming sustainable produce."	"It is to remind me that I should behave in a sustainable way."	"It is to increase my knowledge on sustainable products."	None of the preceding.
Roll-up at the restaurant entrance/ Display at the restaurant table (identical text)	46.3	0.0	4.9	43.9	4.9	0.0
Display at the plate issuance	31.4	0.0	0.0	68.6	0.0	0.0

FIG. 7.3.2: EXPERIMENTAL DESIGN



TAB. 7.3.2: SAMPLE HOTEL

Attribute	Specification
no. of rooms	250
quality level	4 Star
type of board	breakfast, half-board, all-inclusive
restaurant type	all-you-can-eat buffet for all board types
restaurant capacity	95 tables = 190 seats
guest mix	Germany: 22.9% Denmark: 9.4% United Kingdom: 21.3% Sweden: 14.7% Netherlands: 12.3% Norway: 13.7% other: 5.7%

TAB. 7.3.3: GUEST PRESENCE

Day	Baseline	Test Phase
	No. of guests	No. of guests
1	365	380
2	382	395
3	405	387
4	417	371
5	401	414
6	416	411
7	389	394
average	396	393

TAB. 7.3.4: GUEST DATA

		Baseline Phase	Test Phase
country of origin		Germany: 25.6%	Germany: 20.1%
		Denmark: 9.8%	Denmark: 9.0%
		United Kingdom: 21.3%	United Kingdom: 21.2%
		Sweden: 13.8%	Sweden: 15.7%
		Netherlands: 8.8%	Netherlands: 15.8%*
		Norway: 13.7%	Norway: 13.8%
		other: 7.0%	other: 4.4%

*denotes significant difference at the 5% level

TAB. 7.3.5: WASTE MEASUREMENT

Baseline	Test Phase	Δ Test Phase – Baseline per guest in g	Δ Test Phase – Baseline per guest in %	sig. (1 tailed)
edible plate waste per guest in g	edible plate waste per guest in g			
13.84	13.03	-5.85	-5.85	
18.72	16.46	-12.08	-12.08	
20.86	12.02	-42.41	-42.41	
21.34	18.06	-15.39	-15.39	
20.32	17.27	-15.02	-15.02	
18.99	17.76	-6.47	-6.47	
14.65	15.61	6.53	6.53	
18.39	15.74	-2.65	-14.39	

TAB. 7.3.6: SURVEY RESULTS – FOOD CONSUMPTION BEHAVIOUR (AVERAGE ON 3 POINT LIKERT SCALE FROM 1 = I ATE LESS THAN USUAL TO 3 = I ATE MORE THAN USUAL.)



Statement/Question	Baseline Phase	Test Phase	sig. (1 tailed)
How would you rate the overall amount of food you consumed from the hotel buffet at breakfast during the preceding week?	2.23	2.41	0.031

TAB. 7.3.7: SURVEY RESULTS – ATTITUDES TOWARDS SUSTAINABLE FOOD (AVERAGE ON 7 POINT LIKERT SCALE FROM 1 = I TOTALLY DISAGREE TO 7 = I TOTALLY AGREE)


Statement/Question	Baseline Phase	Test Phase	sig. (1 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

TAB. 7.3.8: SIGNAGE PERCEPTION


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



STUDY III: FOOD WASTE IN HOTELS – CAN DIRECT COMMUNICATION AT THE POINT OF CONSUMPTION REDUCE THE ATTITUDE-BEHAVIOUR GAP?

 <p>UNITED AGAINST WASTE</p> <p>Danke! THANK YOU! (Gast)</p> <p>Gemeinsam gegen Verschwendung</p> <p>Unidos contra el desperdicio</p>				
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Appendices

APPENDIX 7.3.1: OVERVIEW OF THE COMMUNICATION INSTRUMENTS

Installation Location	Instrument	Text on the Instrument (in English, German, Spanish language)	Message Intent
Hall/entrance		<p>UNITED AGAINST WASTE WE HANDLE FOOD CAREFULLY SO THAT LESS IS WASTED.</p> <ul style="list-style-type: none"> • 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. <p>WHAT CAN I DO?</p> <ul style="list-style-type: none"> • 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. <p>1/3 OF THE FOOD ON EACH PLATE IS WASTED – WE CAN PREVENT 50 % OF THIS!</p>	<ul style="list-style-type: none"> • imposition of social norms • increase in perceived marketplace influence • increase of knowledge on sustainability issues

<p>Guest tables</p>		<p>1/3 OF THE FOOD ON EACH PLATE IS WASTED – WE CAN PREVENT 50 % OF THIS!</p> <p>We handle food carefully so that less is wasted.</p> <ul style="list-style-type: none"> • 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. <p>UNITED against waste! WHAT CAN I DO?</p> <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • imposition of social norms • increase in perceived marketplace influence • increase of knowledge on sustainability issues
<p>Plate issuance</p>		<p>UNITED AGAINST WASTE – THANK YOU!</p>	<ul style="list-style-type: none"> • imposition of social norms • increase in perceived marketplace influence

APPENDIX 7.3.2: 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)*	6.9	8.2
age distribution (years)	18 - 25: 31.3% 26 - 35: 20.3% 36 - 45: 4.7% 46 - 55: 23.4% 56 - 65: 9.4% n.a.: 10.9%	18 - 25: 28.8% 26 - 35: 16.7% 36 - 45: 6.1% 46 - 55: 37.9% 56 - 65: 7.6% 66 - 75: 1.5% n.a.: 1.5%
gender	male: 46.9% female: 46.9% n.a.: 6.3%	male: 37.9% female: 57.6% n.a.: 4.5%
country of origin	Germany: 33.8% Netherlands: 3.1% Sweden: 21.5% United Kingdom: 16.9% other: 24.6%	Germany: 24.2% Netherlands: 12.1% Sweden: 13.6% United Kingdom: 22.7% other: 27.3%
av. travel party size (only if stated)	2.3	2.5
education	compulsory school degree: 1.5% completed apprenticeship: 16.9% high school degree: 30.8% university degree: 29.2% n.a.: 21.5%	compulsory school degree: 4.5% completed apprenticeship: 12.1% high school degree: 25.8% university degree: 40.9% n.a.: 16.7%

*denotes significant difference at the 5% level

8 CONCLUSION

The globalization age is shaped by new multi-faceted economic, environmental, and social risks whose structure and extent cut across traditional boundaries between nation states, as well as corporations and private actors. This is especially relevant for tourism, since these risks directly endanger the economic, environmental, and social balance of often particularly vulnerable destinations. Especially in times of reduced public spending, an increased responsibility of private businesses and consumers for handling these risks is apparent, whereby these actors also possess a relatively increased agency for discharging their responsibility. One strategy to display responsibility is an increasing adoption and implementation of sustainability innovations. This dissertation has sought to investigate if and under which conditions such an increased adoption and implementation appears possible, taking the case example of sustainable food in the hotel industry.

The first indication stems from study one. It was shown that typical package holiday products such as all-inclusive holidays cannot, in their current form, be considered sustainable with respect to food. The adoption and implementation of sustainable food practices would imply considerable changes in the business model of hotels offering these products. Consequently, sustainable food can be considered a radical innovation for mass holiday resorts.

The second study identified another barrier for the increased adoption and implementation of sustainable food practices; namely, the complexity of the segment of package holiday travellers willing to buy sustainable food travel products. This complexity lowers the robustness of the determinants of this segment's buying decisions and thereby impedes straightforward marketing strategies for hotels.

At the same time, it was shown that machine learning approaches permit an informed prognosis of sustainability-related consumer decisions. Furthermore, these approaches help to describe the complex segment of sustainability-conscious consumers more accurately. Researchers should therefore leverage the potential of machine learning models and use them next to traditional linear models to gain a more comprehensive understanding of hotel customers. Hotels should then use the research results and increase the consumer acceptance of the concept of sustainable food through tailored food offers.

Finally, the third study showed that package holiday travellers are willing to change their food consumption behaviour at the point of consumption as a reaction to a multi-intentional informational prompt. This finding indicates that hotel guests are willing to act as citizen consumers even within a context favouring unsustainable behaviour. Hotels should use this willingness of their guests to more actively integrate them into the handling of societal sustainability challenges.

Finally, to summarize the findings of the three studies, it can be concluded that a shift towards an increased adoption and implementation of radical sustainability innovations such as sustainable food only appears possible as a result of a simultaneous effort by consumers and hotels. Consumers need to actively demand the adoption and implementation of sustainable food practices from hotels and adjust their consumption behaviour accordingly. They should reinterpret their role and develop from passive recipients of services to active contributors to the industry's improvement towards sustainability. At the same time, hotels should be more receptive to their socioeconomic environment and address sustainability problems in collaboration with their customers. This could be the first step for the hotel industry to change its mission from the mere provision of services to an active contribution to sustainable development goals.

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