Transitioning to smart sustainable tourist accommodation: Service innovation results

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ABSTRACT

This research experiment is the first study to provide detailed insights into resource use by guests staying in self-contained B&B style accommodation. Self-contained accommodation is a neglected yet important sub-industry in the hospitality sector, as it represents the largest and fastest growing share of accommodation providers in many regions. The study provides valuable data from a smart metering system, collecting data every minute over four seasons and indicates sustainable consumption opportunities using renewable energy, guest behaviour change and eco-conservation. Our results reveal that guests, when exposed to sustainability advice and communication (i.e. Intervention Group), saved 27% electricity, 22% gas, 22% water and 10% firewood. Differences between Intervention and Control Groups were also observed in terms of daily peak consumption and seasonal patterns. There are further saving opportunities, but findings also highlight social practice complexities to navigate guests' individual thermal comfort knowledge and daily routines. Transitions can be achieved through advanced smart services for direct and indirect customer feedback and host training. This paper is the first to detail findings from smart meter monitoring using high resolution at tourist accommodation, providing new insights into social practices and analysis of water energy nexus.

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1. Introduction

The tourism industry needs to transition to more sustainable social practices as its growth and associated resource use have increasingly detrimental consequences. Tourism is booming with 1.322 million international visitors in 2017 and a growth rate of over seven percent (UNWTO, 2018). Tourism's growth comes with a considerable resource footprint, for example from the travel component but also from tourist accommodation (Becken, 2013; Scott et al., 2008). Indeed, hotels and other types of accommodation can be some of the most energy intensive buildings (Eras et al., 2016), and global carbon emissions from hotels alone amounted to about 150 Mt of CO_2 (carbon dioxide) in 2014 (Global Sustainable Tourism Dashboard, 2017). Tourism's energy consumption is forecast to double by 2040 (Gössling and Peeters, 2015).

The accommodation category of self-contained peer-to-peer Bed & Breakfast (B&B) style accommodation has seen particularly strong growth, demonstrated, amongst others, by the rapid rise of platforms like Airbnb with over 200,000,000 members in 65,000 cities (Dolnicar, 2018). In those self-contained types of accommodation, guests have considerable autonomy over management of the 'asset' and facilities, and as a result the level of resource use. However, very little research has been done on this type of accommodation, despite some interest in sustainable accommodation more broadly (Becken and Dolnicar, 2016; Warren and Becken, 2017). Sustainable accommodation relates to "a business which provides overnight facilities for tourists, monitoring environmental, social and economic impacts and takes responsible action to minimise the negative and maximise the positive impacts, by involving the customers as a partner, to producing a better holiday experience," (Warren, 2012, p.41).

A recent review of the relevant academic literature highlighted several other major gaps. Warren and Becken (2017) found that there is insufficient guidance on what initiatives different types of accommodation can take to reduce resource consumption, in particular in relation to small scale self-catering accommodation types. Specifically, there was a dearth of studies on the human element of resource saving, both in relation to staff and guest behaviours. The review recommended more interdisciplinary approaches that integrate interactions between buildings and

infrastructure, technology, and behaviour for cleaner production, reiterating earlier calls for inter-disciplinary research in sustainable tourism to capture inherent complexities (Budeanu et al., 2016). The lack of socio-technical energy research is not specific to tourism, but has been identified in other fields of practice (Higginson et al., 2015). Social factors are an important missed opportunity because environmental attitudes of managers have been found to significantly affect a firm's environmental innovation progress (Long et al., 2017). Moreover, research shows that consumers can apply self-control when a product or service elicits a pre-commitment towards sustainability (Thaler, 1980).

Guest behaviour accounts for a significant share of resource use at accommodation and therefore represents a critical element of sustainable tourism. Understanding environmental attitudes of visitors is therefore important (e.g. Brownlee et al., 2014; Juvan and Dolnicar, 2014), but in itself is unlikely to lead to measurable changes. Instead, it is crucial to further our holistic understanding of 'accommodation as a social practice'. This means that research needs to take into consideration the available amenities, understand the level of guests' know-how to use such facilities, and place the savings potential into the particular context of the location of the business (Shove et al., 2012). As argued by Shove et al. (2012), researching or changing social practices must also consider people's values and emotions, and the meaning they derive from certain activities. The social practices of 'staying at tourist accommodation', involves guests performing a series of routines that include, for example everyday life routines (personal hygiene, eating, sleeping) or extraordinary activities (e.g. ordering room service). A key factor is that these routines occur in unfamiliar places, both in terms of climatic zones but also in relation to specific equipment (e.g. heating) (Warren et al., 2017 . Understanding visitors' social practices is therefore an important step towards transitioning tourist accommodation towards lower resource consumption. This research posits that providing eco-friendly equipment is equally important as offering guests the advice and know-how to use it.

The main source of energy use in tourist accommodation is electricity, accounting for about 70% of total energy use (Becken et al., 2001; Warren and Becken, 2017). The second most important energy source is gas, which is commonly used for heating water and cooking, and wood as an important fuel in rural areas (Nepal, 2008). In addition to energy use and associated carbon emissions, consumption of other resources is of interest as well. Water, in particular, can be a limited resource in some environments, and through the water energy nexus, carries considerable embodied energy which can be reduced by conservation of water use (Becken and McLennan, 2017; Lam et al., 2017). There is considerable resource conservation potential in B&B style accommodation, as demonstrated in Australia by DEWHA (2008) who estimate that household saving potential is substantial, in particular in relation to space heating, appliances, water heating, and space cooling. All of these involve the complexities of social practice in everyday life, but we have yet to understand if such ambitions can be translated into the holiday context (Barr et al., 2010).

One challenge in influencing guest behaviour is that we cannot see how guests are currently consuming resources 'behind closed doors' (Juvan and Dolnicar, 2016). Since human behaviour is a critical factor of resource consumption (Nguyen and Aiello, 2013) we need to learn if guests respond to education and skills transfer to adjust their behaviour and, in particular, improve actions related to their thermal comfort and routines. This is because much focus has been given to technological efficiencies in accommodation (Becken, 2013; Warren and Becken, 2017), but little research considers the important role of conserving resources due to behavioural changes (Vidmar, 2010). While eco-efficiencies focus on maintaining the same service experiences but with fewer resources, eco-conservation is the guest's deliberate action to lower their resource use by changing the experience and/or how they use particular technology. Social practices research could positively contribute to eliciting the potential for guests to choose eco-conservation whilst staying at accommodation.

Examining the impact of behavioural changes amongst guests requires sophisticated monitoring systems. To capture potentially small reductions in resource use, it is necessary to monitor utilities at a high frequency (Eras et al., 2016). This can be achieved by using intelligent technologies to monitor consumption in 'real time' and provide feedback to both owner and guest at high resolution (Warren, 2018). Thus, the aim of this study is to assess the effects of a persuasive smart service intervention on guests' resource use. This research provides important empirical insights for B&B style businesses that seek to transition towards more sustainable practices and service delivery. This leads to three specific questions:

Q1. Can guests be persuaded to adapt their behaviour to use fewer resources, and are there seasonal differences?
Q2. Do guests modify their daily routines whilst on holiday to comply with the host's request to use fewer resources?
Q3. What is the impact of communication of responsible practices on peak guest demand during their stay?

This research makes several major contributions: a) we present for the first time detailed findings from an innovative smart service system that assesses electricity, gas, firewood and water use at self-cratering B&B style accommodation, thus addressing a major knowledge gap (Coles et al., 2016); b) we generate new insights into social practices that are relevant to self-catering accommodation and identify the need to improve guests competencies; c) we provide data to assess the importance of the water energy nexus, actual savings and alternative energy use in response to particular behavioural interventions; and d) we identify peak demand periods and associated conservation benefits (Lam et al., 2017).

2. Theoretical background

2.1. Social practices

The theory of social practice seeks to understand how people interact with their environments and how in turn, material and geographic context influence common behaviours. Social practices research is also seeking to design interventions that effectively alter practices towards more sustainable outcomes (Higginson et al., 2015). A social practices approach towards reducing resource use at self-catering accommodation implies that, rather than studying individual decision making, it is the guests' activities and routines (e.g. cooking, washing, heating) that are at the centre of analysis, as these ultimately determine resource use. Higginson et al. (2015) examined how different elements of practices, such as people's skills and competencies, technologies, infrastructures, ideas and meanings, combine and how these can inform energy models for modelling or modifying future demand.

Social practices can be a single practice or a multitude that form a 'block' (Reckwitz, 2002) or a 'network' (Higginson et al., 2015). Transitions may occur when all elements of materials (e.g. building design, equipment), competency (e.g. the host of tourist accommodation to deliver a particular service) and meaning (e.g. the comfort provided by an open fire) are linked together simultaneously and performed by individuals who are the carriers of the practice (Shove et al., 2012). Innovative changes can occur when practices mesh with new features and resources (Urry, 2011), which is the essence of our inquiry.

The meaning of holiday-related practices is particularly relevant