Environmental sustainability in hotels: a matter of category?

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Abstract: As in other economic activities, companies in the hospitality industry have proposed several practices and implemented technology solutions to pursue environmental sustainability of their activities and minimise their impact on climate change. Some applications of information and communication technologies (ICT) may contribute to the reduction of the demand of supplies, water and energy by hotels. In the present paper, we aim at exploring the influence of the hotel category on the implementation of environmental-friendly technologies in hotels. Considering a sample of Spanish hotels in the most important cities, we evaluate the relationship between the level of implementation of certain technology solutions and the hotel category. As a result, we observe that, in general, the higher the hotel category, the more intensive the investment in technology solutions. Notwithstanding, for some particular technologies, no significant differences across hotel category are observed. Therefore, we conclude that lodging in an environmental friendly hotel is not a category consideration and we provide a set of recommendations for practitioners and policy makers that may orientate their decisions on ICT for the hospitality industry.

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1 Introduction

Environmental sustainability has become a key aim for hotel managers because of
internal efficiency, the compliance with governance regulations and the customer point of
view (Tzschentke et al., 2004). The strategic use of the information and communication
technologies (ICT) constitutes one of the main marketing and cost saving opportunities
for the hotel industry at present. In this sense, the Davos Declaration, following the
UNWTO's 2nd International Conference on Tourism and Climate Change held in 2007,
has urged for tourism to improve the use of technology (Becken, 2008). Due to the
magnitude and speed of environmental changes, several strategies to stop climate change
have been undertaken. Nevertheless, very few studies have paid attention to the role of
ICT in environmentally-friendly policies in the hospitality industry.

In this regard, ICT are positively contributing to hotel internal performance through
improving water management and energy efficiency (UNWTO, 2002, 2008; Law and
Jogaratnam, 2005) and resource consumption (International Tourism Partnership, 2009).
Additionally, technology applications may allow hotels to comply with environmental
guidelines and accreditation programmes (Knowles et al., 1999; Font, 2002; Bendell and
Font, 2004; Bohdanowicz, 2006). Lastly, hotels can make use of ICT to develop a deeper
knowledge of customer needs, behaviours and preferences (Olsen and Connolly, 2000;
Minghetti, 2003) and effectively reply to customers' increasing appreciation of
environmentally friendly efforts of tourism businesses (Andereck, 2009).

However, there has been a tendency for tourism businesses to develop with little or
no strategy addressing the issue of environmental sustainability (Hall et al., 2005). While
Orfila-Sintes et al. (2005) provide evidence of higher-categories hotels being more
innovative than lower-categories hotels, there is still little evidence of the extent to which
different types of hotels adopt environmentally sustainable technologies. Furthermore,
the literature has warned about the scarce implementation of ICT by small and medium-
sized hotels and independent companies (Main, 2001; Paraskevas and Buhalis, 2002) and
emphasised the need to explore in greater depth the current state of information systems
of hotel establishments (Martínez et al., 2006).

Focusing on the relationship between environmental sustainability and ICT, this
paper aims to analyse the level of implementation of environmentally-friendly
technologies in hotels as well as exploring the influence of hotel category on the use of

these technologies. In order to achieve these objectives, the paper is structured as follows: First, the literature on environmental sustainable ICT in hotels is reviewed. Second, the potential link between environmental sustainability and hotel category is discussed. Third, the research method used and the analysis conducted using a sample of 200 Spanish hotels are described. Finally, the conclusion section summarises the main points of the paper.

2   Environmental sustainable ICT in hotels

Information and communication technologies include all forms of technology used to "create, capture, manipulate, communicate, exchange, present and use information in its various forms – business data, voice conversations, still images, motion pictures, multimedia presentations" [Ryssel et al., (2004), p.198]. Hotels are implementing ICT more intensively in comparison to companies in other industries and businesses (eBusiness W@tch, 2006; Observatorio, 2007a, 2007b). However, several studies report an underutilisation of the potential provided by these applications in spite of their advantages (Hensdill, 1998; Martínez et al., 2006). In fact, hotel managers still barely appreciate the importance of ICT for business development strategies (Law and Jogaratnam, 2005). Furthermore, it has been argued that successful hospitality companies will be those that use the technology in an effective way to immediately satisfy constantly changing customer desires and needs and to cope with environmental changes (Olsen and Connolly, 2000).

Regarding environmental sustainability, tourism activities have been urged to minimise both their direct impact on the climate (e.g., Swarbrooke, 1999). It has been estimated that 75% of hotel environmental impacts can be attributed to the excessive consumption of non-durable goods, energy and water, followed by emissions released into the air, water and soil (APAT, 2002). In order to minimise these environmental impacts, hotel environmental management practices for energy, water use and waste management have been suggested (International Tourism Partnership, 2009). These practices include, among others, reducing non-durable goods supplies and water and energy use as well as measuring and monitoring regularly hotel progress regarding energy, water use and waste management. To follow these practices, ICT may be useful to reduce hotel environmental impact.

In the case of Spain, it has been highlighted the importance of preserving environmental elements that sustain the tourism model. This involves a progressive restructuring towards a knowledge sector through innovation and ICT implementation (Pedreño-Muñoz and Ramón-Rodríguez, 2009). Furthermore, environmental strategies have been pointed out as a crucial factor in the hotel competitive position (García et al., 2002). Notwithstanding, the relationship between environmental strategies and firm performance remains inconclusive. On one hand, some studies provide evidence supporting that environmental practices impact significantly on several performance variables (Molina-Azorín et al., 2009). On the other hand, it has been pointed out that hotels with more developed environmental strategies are associated with a higher level of environmental performance but not necessarily with economic performance (Carmona et al., 2004).

Hotels have implemented a wide range of both climate and non-climate related technologies (Law and Jogaratnam, 2005; eBusiness W@tch, 2006; Observatorio, 2007a,

2007b), with some of them potentially useful in reducing hotel demand for supplies, energy and water use. A catalogue of ICT solutions implemented by hotels is displayed in the Appendix.

Environmentally friendly technologies or clean technologies are defined as those that improve the environmental quality (Yaw, 2005). Companies in the hospitality industry are large users of consumer goods and it is the waste generated by their use that is probably the most visible effect the sector has on the environment. ICT solutions may allow hotels to reduce supply demand and recycle or reuse a large proportion of this potential waste (Bohdanowicz, 2006). It is particularly important the use of office software, online promotion and booking, information analysis and report management systems, ERP systems, ICT systems connected to suppliers, and intranets and the internet. These solutions provide hotels instruments for participation and interaction with their stakeholders (Murphy et al., 2003; Observatorio, 2007b) and a means to reduce the demand for paper supplies. Also, since an increasing number of tourists are concerned about environmental issues, internet utilities can be used by hotels to communicate their achievements to their customer-base. In particular, Travel 2.0 -wikis and blogs, i.e., websites created by users that are nourished by collective intelligence and experience- is oriented towards the traveller and constitutes a new version of 'word-of-mouth'. Web 2.0 is a social network addressed to hospitality professionals. An increase in active consumer participation can benefit tourism companies so that users' opinions may enable hotels to improve their knowledge about customers to cover the needs of new market segments (Fundetec, 2008) without conducting resource-consuming market research.

It has been estimated that 30–50% savings in water and energy could be achieved with the use of ICT solutions such as low-consumption light bulbs, energy control systems, integration of day-lighting, occupancy sensors for lighting control, master power cards, computerised building management systems and other ambient intelligence applications (APAT, 2002; Notarstefano, 2008). Ambient intelligence consists of electronic sensitive environments able to respond to the presence of people, providing customised added-value services and energy savings at the same time (Notarstefano, 2008). In addition, other applications of ICT can contribute directly to the reduction of the demand for water and energy. In particular, the use of GPS can contribute to reducing greenhouse gas emissions from tourism transportation activities.

In the present paper, we aim at responding at the following research question:

RQ1   How intensively do hotels use environmentally sustainable technologies?

3   Environmental sustainability and hotel category

In the hospitality and tourism industry, hotel category is determined by rating systems that allow customers to select particular facilities and service quality, although rating systems differ from country to country (Su and Sun, 2007), and across regions in the same country. Spain, the fourth most important tourism destination in the world in terms of number of tourism arrivals (UNWTO, 2011), was one of the first European countries to regulate hotel category in 1968. Since 1986, Spain's seventeen autonomous regions have developed their own standards resulting in seventeen different hotel rating regulations. In spite of its long history of use of hotel rating systems, Spain still classifies its hotels using criteria centred on architectural, technical and structural elements rather

than service quality (Hosteltur, 2007). However, hospitality companies are investing heavily in ICT to improve internal processes and service delivery to customers (Law and Jogaratnam, 2005; Observatorio, 2007a, 2007b).

Additionally, most Spanish hotels are small and medium-size companies and over 80% are independently owned and managed, employing less than ten people (Observatorio, 2007a). These companies face financial restrictions and their investment in environmentally-friendly ICT depends greatly on the hotel manager's attitude, knowledge and financial situation (Bohdanowicz, 2006). The Spanish tourism authorities provide financing under special conditions to encourage companies to invest in ICT. Turismo 2020 – the Strategic Plan of the Spanish Tourism Board – , FuturE Turismo 2010 and Avanza2 Plan are examples of governance plans to encourage an intensive and generalised use of ICT by Spanish companies, with special attention given to projects that address water and energy savings in tourism activities as a way to contribute to the sustainable economic recovery of Spain.

On the demand side, there is evidence that some customers are willing to pay more for products and services from travel companies that engage in environmental protection innovations (Travel Industry Association, 2003), particularly, environmentally friendly accommodation (Fairweather et al., 2005). A survey was conducted to travellers passing through Hartsfield Airport in Atlanta and Dulles International and National Airports in Washington DC showed that 70% of a sample of travellers reported they were likely to stay in hotels with environmentally responsible practices (Watkins, 1994). In particular, a high percentage of respondents are likely or extremely likely to stay in a hotel when it offers environmental services such as energy-efficient lighting (69.4%), recycling bins for guest use (67.5%) and in-room displays printed on recycled paper (65.1%). Similarly, it has been observed that environmentally-friendly practices exert a positive influence on customer perceptions of tourism businesses (Andereck, 2009). Tourists coming from Western Europe countries such as Germany, UK, Sweden and Norway, which have well-established programmes dealing with life-cycle assessment of products and eco-labelling, are specially concerned about environmental problems (Carlson et al., 1996) and are more likely to appreciate tourism companies efforts to pursue sustainability (Tang et al., 2004; Mehmetoglu, 2009). Since most tourists in Spain come from these countries and from France and Italy (Ministerio de Industria, Energía y Turismo, 2012), they are likely to take into account in their choice of accommodation those hotels with environmental-friendly technology practices.

Thus, ICT represents a means by which hotels can attract customers. It has been argued that higher-categories hotels are likely to be more innovative than lower-categories hotels (Orfila-Sintes et al., 2005). However, previous research has tended to use an aggregated measure of technological innovation that does not identify the specific ICT solutions differentiating upscale hotels from their competitors in lower categories. This led Martínez et al. (2006) to emphasise the need to explore in greater depth the current state of information systems of hotels and how they can be developed to allow greater differentiation of environmentally-friendly technological and other practices. In this sense, this paper proposes the second research question as follows:

RQ2   Are there significant differences in the use of environmentally-friendly
            technologies across hotel category?

4   Method and analyses

The researchers conducted a personal survey of managers of 3-, 4- and 5-star hotels in the three largest Spanish cities and main tourism destinations (namely, Madrid, Barcelona, Valencia and Alicante) identified in Visitingspain.es. Most of hotels in our sample are located in urban cities of Spain. Concerning the selection of Madrid, Barcelona, and Valencia, the tourists hosted in hotels in these three tourism destinations jointly represented 28.74% of the total number of tourists in Spanish hotels during 2011, according to the Spanish Institute of Statistics (INE, 2012). Madrid and Barcelona are the two main tourism destinations in terms of number of arrivals, with 10,400,994 and 10,041,742 hotel guests in 2011. In turn, hotels in Valencia have hosted 2,557,642 visitors in 2011, being the third city in Spain and one of the most fast-growing regions in terms of number of tourist arrivals (INE, 2012). A random sample of hotels was visited by the researchers, who administered the questionnaire and finally obtained a total sample of 200 valid questionnaires, i.e., with responses to all questions, gathered from June to September 2009. Sample details are displayed in Table 1.

Table 1   Sample details

Variables	Frequency	%
Region:		
• Barcelona	65	32.5
• Madrid	60	30.0
• Valencia	75	37.5
Category:		
• Three stars	90	45.0
• Four stars	83	41.5
• Five stars	27	13.5
Main type of customer:		
• Wholesale travel agents	60	30.0
• Retail travel agents	9	4.5
• Companies	77	38.5
• Event planners	3	1.5
• Individuals (guests)	54	27.0

The questionnaire included a wide catalogue of ICT solutions implemented by hotels and identified in the literature (Buhalis, 1998; eBusiness W@tch, 2006; Observatorio, 2007a, 2007b; Buhalis and Law, 2008). Assessments about the level of use of each ICT solution were rated on a five-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5).

In order to assess the level of use of each ICT solution and to test the existence of significant differences in ICT use across 3-, 4- and 5-star hotels, mean values were calculated for each assessment in each hotel category and an analysis of variance through the Tukey post-hoc multiple comparison test was performed (Tables 2 and 3).

Table 2   Intensity of use of hardware, connectivity and software: mean values and ANOVA analysis

	3 stars	*4 stars*	*5 stars*	*Differences across groups**
Hardware	*3.62*	*3.63*	*4.05*	*3–5, 4–5*
Desktop PC	4.70	4.90	4.59	3–4, 4–5
Laptop PC	2.67	2.62	3.70	3–5, 4–5
Server	4.37	4.67	3.92	-
Hardcopy system (USB memory, portable hard disk)	4.48	4.27	4.19	-
PDA	2.40	1.87	3.44	3–5, 4–5
Digital phone communications	3.36	3.29	4.11	4–5
Mobil phone communications	3.88	3.89	4.30	-
Fax	4.60	4.48	4.44	-
Call centre	4.48	4.74	4.40	3–4
Digital camera	2.87	2.67	3.85	3–5, 4–5
LCD screen	3.74	4.59	4.37	3–4, 3–5
Touch screen	2.07	3.81	2.60	3–4, 3–5, 4–5
Digital terrestrial television (DTT)	3.48	3.32	3.96	-
DVD	2.50	2.21	3.93	3–5, 4–5
Electronic cash	2.48	2.52	3.07	-
Point of sale (POS) terminal	4.49	4.80	4.41	3–4, 4–5
Domotic systems (alarm, access control, emergency system, video surveillance)	4.17	4.66	4.37	3–4
Connectivity	*3.80*	*3.60*	*4.01*	*4–5*
Internet connection through BRI/ ISDN/ADSL/cable/others	4.63	4.84	4.26	3–4, 4–5
Virtual private network (VPN)	4.58	4.55	4.56	-
Wireless internet connection (red WI-FI)	4.46	4.70	4.41	-
Bluetooth	2.81	1.98	3.30	3–4, 4–5
World wide interoperability (WiMAX)	2.54	1.84	3.56	3–4, 3–5, 4–5
Software	*4.02*	*3.96*	*4.08*	-
Office software	4.59	4.61	4.22	3–5, 4–5
Design software	3.61	3.55	4.22	4–5
Security systems (VeriSign, SAI, antivirus, anti-spam, anti-spyware, firewalls)	4.36	4.53	4.22	–
Electronic invoicing	4.06	4.59	4.22	3–4
Specific departmental solutions	3.87	4.02	3.96	-
Data analysis and report and project management	3.86	4.10	3.96	-
Simulators	3.81	2.25	3.74	3–4, 3–5

Notes: *The Tukey post-hoc multiple comparison test was used to test for the significance of differences between types of retailers. Only the statistically significant differences between groups at the 5% level are shown.

Table 3 Intensity of use of ICT for CRM and communications: mean values and ANOVA analysis

	3 stars	*4 stars*	*5 stars*	*Differences across groups**
Customer relationship management (CRM)	*3.86*	*3.38*	*3.96*	*3–4, 4–5*
Customer information systems (CIS)	4.14	4.11	4.22	-
E-mail marketing/direct marketing	3.84	4.10	4.25	-
Viral marketing	3.56	2.19	3.52	3–4, 4–5
Loyalty programme	3.87	3.14	3.85	3–4, 4–5
Communications with customers	*3.88*	*3.75*	*3.90*	-
Personal phone customer service	4.66	4.70	4.37	3–5, 4–5
Call centre	3.16	3.58	3.89	3–5
Automatic speech recognition	2.44	1.43	2.48	3–4, 4–5
Customer service by fax	4.47	4.28	4.30	-
Customer service by e-mail	4.59	4.77	4.44	4–5
Advertising	*3.56*	*3.45*	*4.10*	*3–5, 4–5*
Promotional CD/DVD	2.94	3.46	4.33	3–4, 3–5, 4–5
Informative website	4.48	4.56	4.44	-
Informative e-brochure	3.73	4.18	3.89	-
e-magazine	3.41	2.75	3.67	3–4, 4–5
Multimedia solutions (3D, virtual tour)	3.26	2.28	4.19	3–4, 3–5, 4–5
Online order reception	*3.52*	*3.11*	*3.64*	*3–4, 4–5*
Own booking system without payment facilities	4.12	4.02	4.41	-
Own booking system with payment facilities	4.09	3.70	4.41	4–5
Computerised reservation system (CRS)	3.45	4.19	3.78	3–4
Global distribution system (GDS)	3.38	4.03	3.63	3–4
Booking system of tourist destinations	3.55	3.12	3.48	-
Dynamic packages	3.74	3.01	3.70	3–4, 4–5
Electronic distribution to corporate customers	3.34	3.05	3.74	4–5
m-commerce	3.38	2.23	3.48	3–4, 4–5
Searchers and metasearchers	3.58	2.85	3.70	3–4, 4–5
Price comparison/predictors	3.48	3.44	3.67	-
Auction websites	3.00	1.73	2.70	3–4, 4–5
Web 2.0 virtual communities	3.09	1.83	2.96	3–4, 4–5

Notes: *The Tukey post-hoc multiple comparison test was used to test for the significance of differences between types of retailers. Only the statistically significant differences between groups at the 5% level are shown.

In order to answer the first research question, focused on the level of use of technology by hotels, we observe from Table 2 that some ICT solutions are widely used, regardless of the hotel category. These include servers, backup systems, cell phones, fax, DTT, electronic cash, local area networks, wireless networks, online security systems, specific departmental applications and software for analysis and management of projects and

reports. All these technology solutions increase efficiency and accuracy and, thus, they ultimately contribute to input reduction, and money and energy savings.

In addition to this, domotic systems, that may include some energy-saving systems, show also a high level of use (above 4 in a five-point scale).

Regarding the second research question – i.e., *Are there significant differences in the use of environmentally-friendly technologies across hotel category?* –, as shown in Table 2, upscale hotels with five stars have shown greater use of laptops, PDAs, digital phones, digital cameras, WiMAX networks and design programmes compared with four-star hotels, which use more intensively LCD displays and touch screens, POS terminals, domotic systems, internet access, office software and electronic invoicing. These technologies have traditionally helped increase operational efficiency through a decreased supplies demand and added greater value to the service delivered by these hotels over those of lower quality (Observatorio, 2007a, 2007b).

Hotel managers were asked about their level of use of the ICT solutions for CRM, customer communications, promotion and online order processing (see Table 3).

The data show that there is a range of applications widely used by hotels of three, four and five stars. These are CIS, direct marketing via e-mail, customer service via fax, website, e-brochures, booking engine without payment facilities, integration with booking systems of tourism destinations and price comparisons. All these solutions reduce the need of paper supplies and brochures, thus reducing the negative impact of the hotel activity in the environment.

In contrast, there are other ICT solutions that are more intensively used by upscale hotels. These are call centres, automated speech recognition, promotional CD/DVD, e-magazine, multimedia solutions (e.g., 3D, virtual tour), booking system with payment facilities, electronic distribution to corporate customers, e-commerce through mobile phone, and positioning in search and metasearch engines.

However, in some instances three-star hotels have made efforts to improve their practices to the level of upscale hotels. Thus, no significant differences were observed between 3- and 5-star hotels regarding their use of viral marketing, loyalty programmes, dynamic packages, presence in search and metasearch engines, auction sites and virtual communities.

Last, the intensity of use of several ICT solutions related to hotel guest service were also evaluated (see Table 4).

Regarding the level of use of technology, there are several traditional technologies such as digital satellite TV, DTT, in-room piped music, and analogical phone that are widely used by all hotels regardless of their category.

Notwithstanding, as Table 4 shows, upscale hotels (five stars) are clearly distinct from the rest in terms in-room technological provision such as interactive and cable TV, DVD and ambient intelligence systems. Thus, 5-star hotels make a substantial effort in investing in ICT solutions to enhance customer experience.

In summary, considering the average values in every technology category, 5-star hotels use all types of ICT solutions more intensively than hotels of a lower category. However, 3-star hotels implement ICT more intensively than 4-star hotels, which may be a result of the high competitive levels in this market segment driving 3-star hotels to differentiate themselves from other hotel brands in the same category. Notwithstanding, since classificatory systems differ across Spanish regions, they may not capture the actual differences among hotels within the various categories.

Table 4 Intensity of use of ICT for CRM and communications: mean values and ANOVA analysis

	3 stars	*4 stars*	*5 stars*	*Differences across groups**
Guest service equipment	*3.40*	*3.04*	*3.74*	*3–4, 4–5*
Video surveillance	4.20	3.80	4.22	3–4
LCD screen	3.37	3.81	4.26	3–5
Touchscreen	2.62	1.51	2.74	3–4, 3–5
In-room equipment	*3.17*	*2.77*	*3.83*	*3–4, 3–5, 4–5*
Digital satellite TV	3.82	4.07	4.37	-
Cable TV	2.99	2.75	4.33	3–5
Digital terrestrial TV	3.74	3.40	4.04	-
Interactive TV	2.93	1.73	3.70	3–4, 3–5, 4–5
In-room DVD	2.19	1.61	3.48	3–4, 3–5, 4–5
Piped music	3.16	2.96	3.59	-
Analogical telephony	4.02	4.14	3.96	-
Digital telephony	2.67	1.94	3.19	3–4, 4–5
Ambient intelligence	2.99	2.32	3.85	3–4, 3–5, 4–5

Notes: *The Tukey post-hoc multiple comparison test was used to test for the
significance of differences between types of retailers. Only the statistically
significant differences between groups at the 5% level are shown.

5 Conclusions

Competing in the globalised hospitality industry leads hotels to implement ICT to improve efficiency and service quality for increasingly demanding customers. Environmentally-friendly ICT solutions enable hotels to reduce supplies and water and energy demand and, at the same time, to satisfy the needs of environmentally concerned customers.

The present research tries to shed light on two research issues: First, how intensively do hotels use environmentally sustainable technologies? And second, are there significant differences in the use of environmentally-friendly technologies across hotel category?

Regarding the first question, in general, there is a high level of technology use by Spanish hotels. This fact supports the idea that the hospitality industry is concerned about the importance of technology for developing environmentally-friendly practices (i.e., saving energy, increasing internal efficiency, reducing paper supplies and brochures, etc.).

Concerning the second research question – i.e., the presence of difference in ICT use across hotel category, the analysis identified some ICT solutions widely used by Spanish hotels regardless of their category (e.g., internet and e-mail), but that some more recent technological developments have been more implemented on a larger scale by upscale hotels (e.g., ambient intelligence). Notwithstanding, the relationship between hotel category and intensity of use of ICT solutions is non-linear. Thus, 4-star hotels do not always show higher levels of technology use than 3-star hotels. In particular, 4-star hotels

use some ICT solutions such as domotic systems, electronic invoicing, and POS terminal more intensively in comparison to hotels of lower category, while 3-star hotels excel in their use of ambient intelligence, video surveillance, Bluetooth, WiMAX, simulators, viral marketing, loyalty programme, e-magazine, multimedia solutions, m-commerce and Web 2.0 virtual communities. Thus, 3-star hotels have made a great effort to imitate ICT solutions of upscale hotels when compared with 4-star hotels. It was argued that this may be a result of the hypercompetitive environment of 3-star hotels and the use of ICT solutions as a differentiation tool by these hotel categories.

In general, the implementation and use of ICT solutions depend on the hotel category and big hotel chains with high financial resources lead the process of ICT implementation. This may explain the absence of differences between 3- and 5-star hotels in the use of several technologies. In particular, viral marketing may have been considered as a useful tool by low budget companies, since the smaller the company is, the more difficult to compete, and thus, the harder the effort in providing e-services to their clients.

6   Managerial implications, limitations and further research lines

The practices of upscale hotels can assist hotels of inferior category to improve the customer perception of their services. One strategy for managers of hotels with limited financial resources could be to establish ICT investment priorities on efficiency and service quality through the use of ICT and their customer profile. In this sense, serving foreign tourists more concerned about environmental issues than national visitors may urge the hotel to implement environmentally friendly technologies.

Although many hotel internal technology solutions are not directly observable or appreciated by hotel guests, environmentally-concerned customers may develop a positive attitude towards the hotel when being informed about the implementation of 'green policies' by the hotel. Thus, hotel managers should inform guests about the investments in environmentally-friendly technologies effected by the hotel.

The present research represents a first approach to the current level of ICT implementation for city-break hotels and further research should be conducted in other tourism destinations such as in rural areas and 'sun and sand' tourism locations and among hotels with different hotel guest profiles. In addition to this, the lack of representation of hotels of some important tourist areas – e.g., Balearic and Canary Islands, Costa Brava – should be considered as a research limitation.

Notwithstanding, managers responding our survey define what environmentally friendly technologies mean by showing how they have shifted to using certain technologies to reduce energy costs. However, internal efficiency gains and attracting customers may be more important reasons for hotels to invest in these technology solutions rather than environmental sustainability.

Additionally, the final impact of some ICT solutions on the environment may be unclear. Thus, for instance, the use of office software may reduce paper requirements, but in exchange, it requires energy and once the computer is obsolete, its recycling process is hard, being some of its components highly pollutant. Furthermore, looking at new technology use on site ignores energy costs of production of the technology. In addition to this, no independent measure of carbon reduction is provided. We rely on manager comments only but these are not explored to find out how managers measure energy cost

saving and, even in this case, this is an indirect and not always accurate measure of energy saving in gross energy use terms.

Therefore, a deeper analysis of the environmental impact of each ICT solution should be conducted. In this sense, more direct measurements of energy and ecological savings that require more than interviews are needed. Finally, indirect environmental costs of tourism through large physical and energy infrastructure required to get tourists to tourist destinations should also be taken into consideration.

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Appendix

Catalogue of the main ICT implemented in hotels

In-house ICT	ICT for external use
• Hotel hardware	• Electronic marketing and sales
PC	Advertising/promotional supports:
Laptop	• Promotional CD/DVD
PDA	• Informative web
3G mobile	• Informative e-leaflet
GPS	• e-magazine
Telesecurity system	• Multimedia (3D, virtual tour)
LCD screens	Online order reception:
Touch-screens	• Hotel booking system without payment facilities
In-room TV:	• Hotel booking system with payment facilities
• Digital satellite TV	• Computer reservations system (CRS)
• Cable TV	• Global distribution systems (GDS)
• Digital terrestrial TV	• Booking system of tourist destinations
• Interactive TV	• Dynamic packages
In-room DVD	• Electronic distribution to corporate customers
Piped music	• m-commerce
Phone:	Self-service technologies:
• Analogical/digital telephony	• Check-in/check-out solutions
• Analogical/digital switchboard.	• Call centre
Ambient intelligence	• Voice recognition applications
• Hotel software	• CRM
Office software	Customer information system (CIS)
Specific departmental software	e-mail marketing/direct marketing
Information analysis and report management	Viral marketing
Project management	Loyalty programme
Simulators	
Expert systems	
Web security	

Source: Adapted from Buhalis (1998), eBusiness W@tch (2006), Observatorio (2007a, 2007b) and Buhalis and Law (2008)

Catalogue of the main ICT implemented in hotels (continued)

In-house ICT	*ICT for external use*
• Network connectivity	• ICT solutions related to C2C communications
Internet connection through RTC/RDSI/ADSL/cable/MTU/PLC/LMDS	Searchers and metasearchers
Local area network (LAN) through cable	Price comparison/predictor
Wi-Fi local area network (W-LAN)	Virtual web communities 2.0
Bluetooth	Auction webs
World Wide Interoperability (WiMAX)	
• Business integrated processes	• Electronic supply management
Intranet	Online order remittance/reception
ERP systems	Use of ICT for supply management
Online monitoring of production time	ICT systems connected to providers
Electronic invoicing	Online warehouse management

Source: Adapted from Buhalis (1998), eBusiness W@tch (2006), Observatorio (2007a, 2007b) and Buhalis and Law (2008)