Using quality function deployment for environmentally sustainable hotels: a combined analysis of customer and manager point of view

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Abstract

This paper aims to integrate customers' and managers' environmental priorities into service delivery design processes. The main research question in this study is to determine the most significant environmental priorities of customers and managers at hotels. To achieve this aim, Quality Function Deployment is implemented as a tool, combining customer expectations and environmental strategies in service design activities. Customers and managers collectively focus to increase environmental sustainability in hotels in several areas such as the presence of the hotel not causing any harm to the environment, the compliance of hotel with surrounding nature, the presence of automatic electricity control, and the effective use of energy and water lavatories containing automatic water saving systems. The primary design characteristics that meet customer expectations and improve environmental sustainability at hotels are the economic use of electricity, water saving systems, use of natural materials, and adequacy of systems not harming environment and human.

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Introduction

The last decade of 1900s have been labelled as the "decade of the environment" in the literature (c.f. Drumwright, 1994; Menon, Menon, Chowdhury & Jankovich, 1999), as the

beginning of business consideration of social and environmental concerns and sustainability. While environmental and sustainability concerns emerge prominently in the manufacturing industry (Dief & Font, 2010),

concerns about destroying the environment (Álvarez Gil, Burgos Jiménez & Céspedes-Lorente, 2001; Carmona-Moreno, Céspedes-Lorente & De Burgos-Jiménez, 2004) have been one of the hot topics in service industries, particularly at hotels (Grobois, 2012). Increased environmental awareness among stakeholders can dramatically change service design approaches and service delivery styles at hotels, as discussed by Kasim (2006). In essence, the environment is a component of services delivered by hotels (Deloitte Consumer Survey, 2008; Robinot & Giannelloni, 2010). Therefore, service design and delivery processes at hotels should concentrate on environmental awareness as a competitive advantage and success factor (Kucukusta, Mak & Chan, 2013; López-Gamero *et al.*, 2011), that will result in increasing sustainability.

On one hand, hotels generally do not evaluate or understand environmental issues accurately or completely (Horobin & Long, 1996; Kasim, 2009; Leslie, 2007; Vernon, Essex, Pinder & Curry, 2003). Bonilla-Priego *et al.* (2011) emphasize hotel managers' limited understanding of the benefits of systematic environmental management activities, which in turn, lowers their motivation to engage in sustainable activities. Zurburg *et al.* (1995) and Horobin and Long (1996) state that hotel managers struggle in deciding what actions and preventions should be taken. In spite of increasing interest in environmental management, a limited number of hotels focus on the sustainable management approach (Gil *et al.*, 2001).

On the other hand, there is a gap in the literature concerning the implementation of environmental strategies that include customer expectations in the hotel industry (Dief & Font, 2010; Deloitte Consumer Survey, 2008; Millar & Baloglu, 2008). Dolliver (2008) suggests that companies should make accurate, timely, and effective decisions on environmental goals and strategies, including what customers demand and expect. Kassinis and Soteriou (2008) and Rivera (2004) state that the economic results of environmental management demonstrate that increasing performance is caused by the demand effect, not cost containment.

Furthermore, Gonzalez & Leon (2001) suggest that environmental innovation motivated by demand is favourably accepted by hotel managers. The World Tourism Organization (1998: 344) states that "guest perception about the accommodation service quality level is influenced by such factors as the state of conservation of the environment, pollution levels, and acoustic pollution. Environmental factors should also be adapted to customer expectations". Considering each of these factors (Lewis & Chambers, 2000; Frooman, 1999), environmental activities at hotels should be directed by hotel managers' perspectives and as well as other stakeholders' perspectives (Heikkurinen, 2010).

This paper aims to integrate customers' and managers' environmental priorities into service delivery design processes. The main research question in this study is to determine the most significant environmental priorities of customers and managers at hotels. To accomplish this, Quality Function Deployment (QFD) is implemented as a tool that combines customer expectations and environmental strategies in service design activities in this study. We were unable to find any study considering customers' and managers' environmental point of view simultaneously in accommodation sector in the literature.

A literature review concerning environmental concerns in the hotel industry and the structure of QFD as a tool to increase sustainability at hotels is the next section. The following section demonstrates the method implemented in this study. QFD procedure section depicts how QFD was utilized at a hotel as a way of closing the gap stated in the literature. The results and discussion are followed by our conclusion.

Literature review

Environmental concerns in the hotel industry

Addressing environmental concerns is an indispensable prerequisite for competitive advantage and corporate reputation (Banerjee, 1999; Miles & Covin, 2000; Rivera, 2002). The desire to reduce costs, the obligation of protecting the surrounding environment, and the need to comply with environmental regulations are other issues of concern (Bohdanowicz, 2006; Vazques, Santos &

Alvarez, 2001, Ogonowska and Torre, 2013). Environmental policies promote performance and success at hotels (Chou, 2014, Chang *et al.* 2015, Eslaminosratabadi, 2014; Brida *et al.*, 2008) and result from a positive relationship between environmental management and financial performance (Gil *et al.* 2001; Blanco, Rey-Maqueira & Lozano, 2009; Garay & Font, 2012; Rodriguez & Cruz, 2007; Tarí, Claver-Cortés, Pereira-Moliner & Molina-Azorín, 2007; Eiadat, Kelly, Roche & Eyadat, 2008; Enz & Siguaw, 1999). Kirk (1995) also presents the positive impacts of environmental policies on both marketing and financial performance.

On one hand, hotels recognize this fact and implement environmental policies in their operations (Revilla, Dodd & Hoover, 2001). There are notable positive effects of environmental policies on decreasing damage to the ecology and preventing global warming (Ayuso, 2007; Erdogan & Baris, 2007; Kasim, 2009; Rahman, Reynolds & Svaren, 2012). However, on the other hand, hotels also consume and affect economic, natural, and social resources creating air pollution, biodiversity loss, waste generation, and climate (Gray & Bebbington, 2001; Kirk, 1996; Webster, 2000). Therefore, the environmental responsibilities of hotels are mostly related to pollution prevention, sustainability of ecological environment, waste management and recycling, renewable energy use, and energy efficiency (Wilson, Smith & Dunn, 2007; Chung & Parker, 2010).

Environmental concern is also intensified by consumers' positive attitudes, intentions, and behaviours towards environmentally friendly hotels (Han, Hsu, Lee, & Sheu, 2011; Lee, Hsu, Han, & Kim, 2010). Watkins (1994), Mensah (2006), and Butler (2008) suggest that the demonstration of an environmentally responsible management policy is one criterion for consumers to choose a hotel. Andereck (1995) shows that consumers rank environmentally responsible activities as being very important in their decision to reside at a particular hotel. Consumers develop positive environmental attitudes toward environmental improvements executed by hotels (The Travel Industry Association, 2003; Fairweather, Maslin

& Simmons, 2005; Pembroke, 1996; Gustin & Weaver, 1996). There is also a relationship between the customer's willingness to pay more and environmental concerns (Adlwarth, 2010; Masau & Prideaux, 2003; Timothy & Teye, 2009; Kang, Stein, Heo & Lee, 2012; Wehrli, Schwarz & Stettler, 2011; Han *et al.*, 2011; Rivera, 2002). A positive connection between return intentions and environmental strategies are mentioned in some studies (c.f., Han *et al.*, 2011; Lee *et al.*, 2010). Berezan, Raab, Yoo and Love (2013) show a positive relationship between environmental initiatives and consumer satisfaction levels. Consumers may ignore some inconsistencies in order to support green initiatives (Kim & Han, 2010).

Although recent studies identify relationships between environmental strategies and various corporate performance indicators, there are limited studies evaluating customers' environmental expectations and perceptions (c.f., Rozman, Potočnik, Pažek, Borec, Majkovič & Bohanec, 2009) in the hotel industry. From a general perspective, Tseng and Hung (2013) examine gaps between customer expectations and perceptions for green products using SERVQUAL. Recyclability ratio, function performance, durability, conformance, user-friendliness, appearance, energy conservation rates, environmental impact of materials, eco-labels, recycled packaging materials, and labelling of product ingredients are factors. Bastič and Gojčič (2012) measure the eco-component of hotel service quality to determine customer ecological expectations in wellness hotels and spas. They identify hotel staff's eco-behaviour, environmentally friendly and healthy equipment, efficient use of energy and water, and bio-food as the environmental dimensions of hotel service quality.

Khan (2003) uses the ECOSERV scale to evaluate environmental expectations about service quality among ecotourists. Khan (2003) finds that eco-tangibles are the most important service dimension among six environmental expectations such as eco-tangibles, assurance, reliability, responsiveness, empathy, and tangibles. Tseng and Kuo (2013) evaluate the gap between customer perceptions and

expectations in the green hotel service quality at a five-star tourist hotel in Taiwan. They discovered six dimensions affecting higher customer perception: environmentally friendly and healthy equipment, efficient use of energy and water, eco-behaviour of hotel staff, bio-food, green products, and environment. Lee *et al.* (2010), in analysing how tourists perceived green hotels in the US, based their study on two green cognitive image components of value and quality attributes. They find that an effective image impacts the green hotel's overall image, which results in more effective behavioural intentions. Additionally, they found that quality attribute are more powerful than value attributes.

Robinot and Giannelloni (2010) examine the impact of green attribute on customer satisfaction in hotel industry, focusing on reusing bed linen and towels and using of clean or renewable energies. They find that green attribute is a basic component of service offer. Han *et al.* (2011) evaluate environmental attribute as a basic of service offer in their research analysing eco-friendly attitude and intention of consumer towards green hotels. Kim and Han (2010) employ beliefs of helping save the environment, staying in a clean and comfortable hotel, eco-friendly practices, having eco-friendly and healthy products and foods as the dimensions of environmental beliefs of customers to evaluate the intention to pay at green hotel.

Watkins (1994) report that customers may focus on environmentally friendly hotel attributes such as using recycling bins, energy-efficient lighting, recycled papers, changing sheets only when requested, and turning off lights in unoccupied guest rooms. Kasim (2004) discover that tourists visiting Malaysia have note whether rooms are equipped with water saving features, recycling bins, fire-safety and energy saving features, and information on local ecotourism attractions. Millar and Baloglu (2008) identify customer preferences for green hotel attributes as energy saving light bulbs, low flow toilets and faucets, less frequent change of linens, recycling bins, occupancy sensors, and key cards.

Prud'homme and Raymond (2013) find that ecological concerns are a dimension of

customer satisfaction in hotels. The customers of 11 tourist hotels identify other customer satisfaction related dimensions as food service, 3R practices, front desk and room, and access. Mensah (2006) examines environmental management practice in hotels in Ghana from a managerial point of view, revealing that managers identified the most popular eco-friendly practices as use of energy-efficient light bulbs, reuse of linen and towels by guests, training staff to be eco-friendly, use of eco-friendly cleaning products, and support for local community.

Erdogan and Baris (2007) evaluate environmental protection programs and conservation practices of hotels among three, four, and five star hotels in Turkey from managers' point of view, mentioning the environmental protection programs, solid waste management, purchasing activities, and energy use and resource conservation as factors. Claver-Cortés *et al.* (2007) analyse environmental management as a source of competitive advantage for three to five star hotels in Spain. Categorizing the proactivity within three groups such as proactive, intermediate, and reactive, they investigate the impact of environmental proactivity on economic performance of the target hotels. The items used to evaluate the environmental strategy in this study were: (1) measurement of environmental costs and savings; (2) employee trainings in environmental issues; (3) ecological purchasing policies; (4) ecological arguments in marketing campaigns; and (5) energy and water saving measures.

There are other studies analysing the environmental strategies in hotel industry based on various perspectives. Bohdanowicz (2006) addresses the significance of energy, water, and waste related issues for the hotel industry in Europe. This study analyses the impact of national geo-political, economic and socio-cultural context on the environmental attitudes and pro-ecological efforts in hotel industry. Bohdanowicz (2006) finds that the economic situation and pro-environmental efforts initiated by the government are impactful on certain aspects of hoteliers' attitudes and actions. Lopez-Gamero *et al* (2011) analyse the organisational perceptions of the

environment among 239 hotel managers in Spain based on organisational aspects and the technical aspect of the environmental management. Their study shows that attitudes and perceptions of managers are crucial for developing environmental strategies.

Brown (1994) analyses the environmental initiatives among UK hotels and finds recycling of cans, paper and food, less frequent change of bed linen and 'green' purchasing policies are the most frequent green practices. Gil *et al.* (2001) analyse environmental management practices at hotels with regard to their impacts on natural environment through environmental training programs, green purchasing policies, energy and water-saving actions, and recycling. Nayak and Sing (2013) evaluate green marketing and utilized the environmental strategy dimensions such as protection, promotion, place, and prolongation. Protection moves managers toward cost efficiency, promotion focuses society's attention toward environmental safety. Place focuses on building the hotels based on environmental safety criterion, and prolongation identifies the importance of recycling.

On the basis of managers' opinions from various sectors in tourism industry, Ahmad (2014) considers several environmental factors such as recycling, using energy saving light bulbs and water systems, and consuming organic food. Grosbois (2012) identifies the dimensions of environmental corporate social responsibility among 150 largest hotels in the world. This study reveals that the important dimensions are reducing energy consumption, renewable energy use, water saving, waste reduction and recycling, improving air quality, biodiversity conservation, preventing ozone, and minimizing carbon footprint and greenhouse gas emissions. Similarly, Kucukusta *et al.* (2013) suggests that environment is one of the five factors of corporate social responsibility. The environmental factor also includes dimensions of employing third parties to conduct energy audits, encouraging staff to minimize the consumption of electricity, and establishing in-house environmental policy for its staff. Leonidou *et al.* (2013) develop a model of the

Greek hotel sector that includes the driver factors of environmental friendly marketing strategies: product-service, price, distribution, promotion, people, atmosphere, and process.

Tzschentkea *et al.* (2008) addresses the most frequent environmental friendly practices among small-size hotels such as recycling, using natural cleaning alternatives, energy and water saving devices, purchasing ethical and environmentally friendly products, and environmental training. Among Mexican hotel guests, Berezan *et al.* (2013) find that energy saving light bulbs and dispensers in hotels have a positive impact on satisfaction and intention to return, while recycling has a negative influence on both intention to return and satisfaction.

QFD for environmentally sustainable hotels

QFD is a manufacturing-oriented tool to improve the outcomes of the design processes, created by Akao in the 1960s at the Kobe Shipyard of Mitsubishi Heavy Industries Ltd. QFD is built on House of Quality (HOQ) that has an algorithm accepting customer expectations (whats) as the main input and transferring those expectations to engineering characteristics (hows) as the main output. QFD is a structured way of combining customer expectations and design characteristics in HOQ. The QFD algorithm is followed within five sections: 1) customer expectations (voice of customer); 2) planning matrix; 3) technical requirements (voice of engineering); 4) relationship matrix; and 5) technical correlation matrix. The first section identifies customer expectations accurately and precisely as *voice of customer*, which is the most crucial section in the entire process of QFD. The *planning matrix* reveals relatively more important customer expectations, including both customer and service designer points of view. The *technical requirements* meeting and exceeding customer expectations are determined in the third section, which is called *voice of engineering* in QFD literature. The *relationship matrix* is constructed on the relationships between voice of customer and voice of engineering. The *technical correlation matrix* depicts the associations, positively or negatively, between and among technical requirements in the roof of HOQ.

There are a great variety of studies on QFD, from a fundamental to a sophisticated level. Even though the literature depicts many developed examples of QFD in manufacturing settings, QFD has not been extensively implemented in service industries (Zuo, Huang, Fan & Zhang, 2013), particularly at hotels. However, QFD can easily be utilized in service design processes since it is presented as a remedy to improve design quality in both manufacturing and service industries. The process in QFD does not differentiate on the basis of the industry because of the nature of the QFD.

Existing studies in the literature are performed with a partial view, instead of the totality of the service delivered at hotels. For example, Akbaba (2005) and Stuart and Tax (1996) employ QFD as a tool to improve service quality in front office operations at hotels, while Kirk and Galanty (1994) utilize QFD on hotel housekeeping systems. Specifically, Stuart and Tax (1996) emphasize the importance of service design processes using QFD methodology at both tactical and strategic levels. Michael, Johnson and Renaghan (1999) utilize QFD in a modified structure in the luxury business hotel segment.

QFD also can be used in hotels either conceptually or hypothetically (Miyoungh & Haemoon, 1998; Ikiz & Masoudi, 2008; Jeong & Oh, 1998; Kaneko, 1992). For instance, Miyoungh & Haemoon (1998) present a hypothetical example for showing how to employ QFD in lodging industry. Similarly, Oke, Ofiabulu, Banjo & Akanbi (2008) present a case study including a combined approach of QFD and Pareto analysis that was developed for hotel industry. Nevertheless, existing studies do not take environmental responsibilities and perspectives into account in service improvement studies that use QFD in hotels. The only study using QFD to present water and energy saving and indoor air pollution level items that are related to environmental service quality in the lodging industry was that of Raggi and Petti (2006). We found no studies in the literature using QFD that focus on the entire service delivery process at hotels.

QFD is implemented in this study because it is an innovative and efficient tool that translates customer expectations into appropriate technical requirements including service designers' perceptions. QFD links the performance of design activities with the sustainability of organisations and allows the consideration of the Deming Chain Reaction. Deming (1986) proposed his Model to explain the relationships among quality, productivity, cost, and eventually, more jobs and sustainability. Quality improvement in any organisational process results in higher productivity. Any improvement in productivity results in cost reduction because of less rework, fewer mistakes and delays, and better use of machine-time and materials. Furthermore, overall improvement in quality, productivity, and cost leads to a significant increase in market share. Eventually, increasing market share improves the organisation's competitiveness in the entire market and enhances the survival possibility of the organisations nationally or globally. In other words, environmental management creates opportunities to increase the competitiveness of the organisation.

After reaching this point, organisations can implement the sustainability concept in corporate strategic priorities and planning. Improved quality is an effective strategy for increasing the sustainability of the organisations. Design functions, processes, and outcomes should first be optimized on the basis of the customer demands, including both consumer and designer perspectives to improve design outcomes in service industries. QFD is an effective way of optimizing design processes and outcomes.

Method

Data collection

This study was performed at a five-star hotel in a national park in Turkey. Because the QFD methodology does not allow the use of multi-organisational data, this study was done with just one hotel. The university-affiliated five-star hotel provides customers with various services, including both long term and daily accommodations. The hotel has two suits, one disabled room, and 312 beds. The 156-room hotel is located in 70 kms from the capital and

80 kms from an international airport. The hotel also provides customers with spring water treatment and spa services, tracking routes, four soccer fields, one tennis court, one swimming pool, and five meeting rooms.

The study utilized a QFD team that formed with two academicians and four upper level hotel managers. The managers were considered competent about services and the academicians chosen are experts on performing QFD. Data used in this study was collected from four sources: 1) one focus group study, 2) past customers' complaints, suggestions, and opinions, 3) evaluations of managers that were on the QFD team, and 4) a research survey particularly conducted in this study.

First, a focus group study was performed with eleven customers who previously were accommodated and experienced services at this hotel. Focus group studies are implemented in various scientific disciplines to empirically determine respondents' opinions and ideas about the relevant research question. Some important contributions to the literature are from studies employing qualitative methods (Cohen, 1988), due to the highly experiential nature of the hospitality industry (Munson, 2014). Krueger and Casey (2000) state that focus groups provide an opportunity to identify a variety of multifaceted ideas and feelings of customers about environmental aspects of hotel service quality. In this sense, the results of the focus group study performed with customers who previously received hotel services were moved into the planning matrix in HOQ in this step.

Second, past customers' complaints, suggestions, and opinions obtained in the 2013 calendar year were used to develop a questionnaire to determine customer expectations. The most frequent complaint was about the inefficient use of energy resources and the lack of environmental compliance. The suggestion mentioned most often was about the need for increasing environmental consciousness among service providers. Third, the opinions of managers on the QFD team and their expert knowledge were employed in

determining customer expectations. The managers' opinions and expertise are a major part of successfully satisfying customers and creating the effectiveness of the employees (Karadag, 2002).

Research survey and sample

As the fourth part of data collection, a research survey was conducted. A questionnaire concerning customer expectations was constructed partially using the eco-component of hotel service quality developed by Bastič and Gojčič (2012). The questionnaire contains 23 items along with three demographic questions. Both customer expectations and perceptions were rated using five-point Likert scale, from 1=unimportant to 5=very important for expectations and from 1=strongly disagree to 5=strongly agree for perceptions.

In terms of content validity, the questionnaire was analysed by the executives at the hotel. Second, the questionnaire was tested with 15 customers who previously experienced the service at the hotel as a pilot study. On the basis of the feedback from the pilot study and from executive opinions, the questionnaire was re-evaluated.

In determining the sample size, it was assumed that the hotel customers were more than ten thousand customers annually with a 90% confidence level and a 0.23% error margin (DeVaus, 2000). The final questionnaire was answered by 380 customers visiting the hotel, based on simple random sampling. Only 302 of them were sufficient and qualified for use in the next steps. The actual response rate turned out to be 79.47%. The QFD team decided to administer the surveys when the customers were in check-out period. The questionnaire was answered by customers themselves using paper and pencil method.

The respondents were volunteers who agreed to participate in the survey. They were informed about the aim of the study and the confidentiality of their responses. The survey continued for a week during the high season of the hotel. The demographic analysis reveals that 35% of the sample was below age of 30,

45.6% were male, and 76% had an undergraduate degree as given in Table 1.

Reliability analysis was performed on the basis of internal consistency. The Cronbach alpha coefficient was found to be 0.956 for the 23 expectation items. In examining construct

validity, the answers given to 23 expectation items were analysed using Principal Component Analysis (PCA) with quartimax rotation to reduce the items to a single set of variables. The Kaiser–Meyer–Olkin score was found to be 0.926. The dimensions, factor loads, and their internal consistency

Table 1. Demographics of sample

Demographics of sample	Frequency
Ages	
Less than 30	35.0%
30-45	23.4%
46-61	30.0%
Older than 61	11.6%
Gender	
Male	45.6%
Female	54.4%
Education	
Secondary education/high school	7.0%
Some college/university/technical school	3.0%
Undergraduate degree from college/university	76.0%
Graduate degree	14.0%
Nationality	Turkish: 100%

Table 2. FA results including factors and factor loadings

	Utilizing Resources Efficiently and Environmental Compliance ($\alpha=0.943$)	Food and Environmental Consciousness ($\alpha=0.926$)	Variance explained
Utilizing resources efficiently and environmental compliance			42%
The presence of the hotel not causing any harm to the environment	0.819		
The compliance of hotel with surrounding nature	0.805		
Effective use of energy	0.801		
The equipment made from natural materials	0.790		
The bed and bed covers made by natural materials	0.789		
Naturally produced floor cover material	0.770		
The use of natural materials in the construction of the hotel	0.728		
The presence of automatic electric control	0.727		
Effective use of water	0.604		
Lavatories containing automatic water saving system	0.598		
Collection of the waste material by the waste boxes	0.587		
Use of environmentally friendly detergents	0.548		
Use of eco-labelled products	0.531		
Food and environmental consciousness			32%
Staff having a good knowledge in environmental conscious		0.809	
Presence of the written advices about the environmental protection		0.809	
Presence of balanced and diverse menus		0.791	
Freshly prepared food		0.751	
Presence of the local and traditional food		0.711	
Presence of the vegetarian food		0.703	
Preparation of the food by the use of organic material		0.703	
Presence of the fresh fruit juices		0.672	
Production of the vegetables and fruits at the hotel surroundings		0.626	
Having opportunity for buying ecological products		0.625	

coefficients are given in Table 2. The data collected in the research survey was utilized in HOQ, as demonstrated in the next section.

QFD Procedure

The following subsections give the details of the implementation of each step of QFD.

Discovering customer expectations

As a factor empowering competitive advantage, QFD starts with learning spoken and unspoken customer expectations (Mazur, 1993) from

current and potential customers, before rivals do. This subsection is the most notable step in QFD process because understanding precisely what customers expect is the most important stage in delivering high-quality service (Zeithaml, Berry, & Parasuraman, 1996). In this step, customer expectations were discovered from four types of data presented in the data collection section, discussed previously. All feedback received from the four sources were assembled into the planning matrix in HOQ.

Table 3. Planning matrix

	Importance rates	Customer rates	Quality plan score	Rate of level up	Priority factors	Absolute weights	Relative weights
Utilizing resources efficiently & environmental compliance							
Presence of the hotel not causing any harm to the environment	4.49	3.97	5	1.26	1.5	8.48	6.3%
The compliance of hotel with surrounding nature	4.43	3.88	5	1.29	1.5	8.56	6.4%
Effective use of energy	4.28	3.79	5	1.32	1.5	8.47	6.3%
The equipment made from natural materials	4.24	3.76	4	1.06	1	4.50	3.4%
The bed and bed covers made by natural materials	4.25	3.75	4	1.07	1	4.54	3.4%
Naturally produced floor cover material	4.27	3.73	4	1.07	1	4.59	3.4%
The use of natural materials in the construction of the hotel	4.28	3.79	4	1.06	1	4.52	3.4%
The presence of automatic electricity control	4.36	3.79	5	1.32	1.5	8.64	6.4%
Effective use of water	4.39	3.89	5	1.29	1.5	8.47	6.3%
Lavatories containing automatic water saving system	4.38	3.82	5	1.31	1.5	8.59	6.4%
Collection of the waste material by the waste boxes	4.44	3.90	4	1.03	1.5	6.83	5.1%
Use of environmentally friendly detergents	4.39	3.84	4	1.04	1.2	5.49	4.1%
Use of eco-labeled products	4.38	3.85	4	1.04	1.2	5.45	4.1%
Food & environmental consciousness							
Staff having a good knowledge in environmental conscious	4.38	3.92	4	1.02	1.2	5.36	4.0%
Presence of the written advices about the environmental protection	4.35	3.80	3	0.79	1	3.43	2.6%
Presence of balanced and diverse menus	4.39	3.93	4	1.02	1.5	6.71	5.0%
Freshly prepared food	4.41	3.94	4	1.02	1.5	6.72	5.0%
Presence of the local and traditional food	4.38	3.95	4	1.01	1.2	5.33	4.0%
Presence of the vegetarian food	4.24	3.88	3	0.77	1	3.28	2.4%
Preparation of the food by the use of organic material	4.32	3.96	4	1.01	1.2	5.25	3.9%
Presence of the fresh fruit juices	4.46	4.02	4	1.00	1	4.44	3.3%
Production of the vegetables and fruits at the hotel surroundings	4.13	3.80	3	0.79	1	3.26	2.4%
Having opportunity for buying ecological products	4.27	3.85	3	0.78	1	3.33	2.5%

The PCA, as detailed in research survey and sample, presented two main dimensions on customer expectations: 1) “*Utilizing resources efficiently and environmental compliance*” (13 items) and 2) “*food and environmental consciousness*” (10 items) as given in Table 2. Even though the PCA resulted in two dimensions, an item by item analysis was performed in the following steps of QFD to make a more detailed analysis on customer expectations.

Constructing planning matrix

A planning matrix has a numerical algorithm using several variables to discover relatively more important customer expectations in HOQ. These variables are *the importance rate, customer rate, quality plan score, rate of level up, priority factor, absolute weight, and relative weight*, respectively. The planning matrix (Table 3) in this study was created by the QFD team.

The *importance rate* in a planning matrix shows how important each expectation is to the customer in question. The importance rates were calculated as the mean of expectation scores given by 302 respondents. As seen in Table 3, all expectation items were greater than 4 points, which means that important customer expectations were reflected in the questionnaire. The *customer rate* demonstrates customer perceptions of service delivery processes. In this sense, the customer rates in the planning matrix were calculated as mean (average) of perception scores given by each respondent (Table 3).

The *quality plan* scores were determined by upper level managers in QFD team as an indicator of the significance given to each expectation by customers. Team members used a 5-point Likert scale using 1=unimportant and 5=very important in considering the strategic directions of the hotel.

The next step in developing the planning matrix is calculating the *rate of level up* scores, as given in Equation 2. *Rate of level up* is a value referring to the improvement needs on customer expectations with regards to customer and managers' views.

$$RL_i = QP_i \div CR_i, i=1,2,\dots, n \quad [2]$$

where n is the number of customer expectation, RL_i is the rate of level up, QP_i is the quality plan score, and CR_i is the customer rate.

Priority factor is a variable that identifies whether the relevant customer expectation has the capability of increasing total firm sales in the near future (Akao, 1990). The scale used in determining priority factor includes three levels. Level 1 utilizes a score of 1 point for no improvement possibility in the sales, level 2 with 1.2 points for medium improvement possibility, and level 3 with 1.5 points for strong improvement possibility (Akao, 1990).

The planning matrix ends with calculating *absolute weights* and *relative weights* for each customer expectation as given in Equation 3 and 4.

$$AW_i = IR_i \times RL_i \times PF_i, i=1,2,\dots, n \quad [3]$$

$$RW_i = AW_i \div \sum_{i=1}^n AW_i, i=1,2,\dots, n \quad [4]$$

where n is the number of customer expectation, AW_i is the absolute weight, IR_i is the importance rate score, RL_i is the rate of level up, PF_i is the priority factor score, and RW_i is the relative weight. The findings of the planning matrix are given in the results section.

Determining technical requirements

QFD is a method to convert customer expectations into technical requirements using a structured algorithm (Akao, 1990). In this algorithm, technical requirements present design outcomes as technical specifications. Technical requirements are called *hows* in QFD literature. The QFD team in this study examined each customer expectation and diagnosed eight technical requirements to meet customer expectations: 1) decoration compatible with nature, 2) economic use of electricity and water saving systems, 3) use of natural material at hotel, 4) presence of recycling systems, 5) giving necessary info about the environmental conscious, 6) food service compatible with the expectations, 7) responsiveness and adequacy of natural food, and 8) adequacy of systems not harming environment and human.

[2]

Building relationship matrix

To build the relationship matrix, associations between technical requirements (hows) and customer expectations (whats) were investigated by the QFD team. Associations were attained with a numeric scale developed by Akao (1990), 9=a strong relationship, 3=a medium relationship, and 1=a weak

relationship. Relationship matrix (Table 4) produces two important variables in QFD, *absolute weight* and *relative weight*, respectively, for each technical requirement as given in Equation 5 and 6.

$$AW_j = \sum_{i=1}^n (r_i * AW_i) \quad j=1,2,\dots,k \quad [5]$$

Table 4. Relationship matrix

	Decoration compatible with nature	Economic use of electricity and water saving systems	Use of natural material at hotel	Presence of recycling systems	Giving necessary info about the environmental conscious	Food service compatible with the expectations	Responsiveness and adequacy of natural food	Adequacy of systems not harming environment and human
Utilizing resources efficiently & environmental compliance								
Presence of the hotel not causing any harm to the environment	9			3	3			9
The compliance of hotel with surrounding nature	9		9	3				9
Effective use of energy		9			3			9
The equipment made from natural materials			9					3
The bed and bed covers made by natural materials	3		9					3
Naturally produced floor cover material	3		9					3
The use of natural materials in the construction of the hotel	3		9					3
The presence of automatic electricity control		9						3
Effective use of water		9						9
Lavatories containing automatic water saving system		9						9
Collection of the waste material by the waste boxes				9				9
Use of environmentally friendly detergents			9					9
Use of eco-labeled products			9					9
Food & environmental consciousness								
Staff having a good knowledge in environmental conscious					9			1
Presence of the written advices about the environmental protection					9			
Presence of balanced and diverse menus						9		
Freshly prepared food						3		
Presence of the local and traditional food								
Presence of the vegetarian food						9		
Preparation of the food by the use of organic material						9		
Presence of the fresh fruit juices						9		
Production of the vegetables and fruits at the hotel surroundings						1	9	
Having opportunity for buying ecological products						1	9	
Absolute Weights	194	307.5	338.8	113	130	204	59.3	270.5
Relative Weights (%)	12%	19%	21%	7%	8%	13%	4%	17%

$$RW_j = AW_j \div \sum_{j=1}^k AW_j \quad j=1,2,\dots,k \quad [6]$$

where AW_i is the absolute weight of i th customer expectation, r_i is the association rate between i th customer expectation and j th technical requirement, AW_j is the absolute weight, k is the number of technical requirement, RW_j is the relative weight.

Constructing technical correlation matrix

Akao (1990) identifies the importance of the relationship between and among technical requirements, a crucial input for further design activities. Any changes in one unique technical requirement may have an effect, positively (+ in Table 5) or negatively (- in Table 5), on any other technical requirements. The technical correlation matrix is illustrated within the roof of HOQ in Table 5.

Results and Discussion

As one of the main findings of this study, 23 environmental expectations are classified into two dimensions using factor analysis: “utilizing resources efficiently and environmental compliance” and “food and environmental consciousness.” The first dimension determined in the planning matrix of HOQ, “utilizing resources efficiently and environmental compliance”, is similar to the “environmentally friendly and healthy equipment” dimension presented by Bastič and Gojčič (2012) and Tseng and Kuo (2013) in their eco-component structure. The second dimension discovered in this study, “food and environmental consciousness”, is also mentioned by Mayer-Smith, Bartosh, and Peterat (2007).

In the planning matrix, there are several findings indicating environmental concerns of

Table 5. Technical correlation matrix

	Decoration compatible with nature	Economic use of electricity and water saving systems	Use of natural material at hotel	Presence of recycling systems	Giving necessary info about the environmental conscious	Food service compatible with the expectations	Responsiveness and adequacy of natural food	Adequacy of systems not harming environment and human
Decoration compatible with nature			+					
Economic use of electricity and water saving systems								
Use of natural material at hotel				+				
Presence of recycling systems								
Giving necessary info about the environmental conscious				+				
Food service compatible with the expectations								
Responsiveness and adequacy of natural food						+		
Adequacy of systems not harming environment and human	+	+	+	+	+	+	+	

customers and service providers at the hotel. The *importance rate*, which demonstrates how important each expectation is to customer, is one of these findings. The highest score on importance rate was given by customers to “the presence of the hotel not causing any harm to the environment” with 4.49 scores, while the lowest score was discovered on “production of the vegetables and fruits at the hotel surroundings” with 4.13 scores. Second, the highest *customer rate* (customer perceptions) was discovered on “presence of fresh fruit juices” with a score of 4.02, and the lowest one was on “naturally produced floor cover material” with a score of 3.73. Previous studies present their results on this particular topic. For example, Tseng and Kuo (2013) reveal that managers give one of the highest scores to “presence of the fresh fruit juices” item. Alfnes and Sharma (2010) discovered that, even when locally produced food is more expensive than the other foods, more customers choose locally produced ones. Similarly, organic food is found to be important to customers in Torres (2002)’s study, which evaluates tourist food consumption and preferences. Lee *et al.* (2010), Ahmad (2004), and Kim and Han (2010) find that organic food is positively associated with visit intention and positive word-of-mouth discussions about the hotel to others. Revilla *et al.* (2001) present “using organic foods in menu” as one of the least important environmental issues mentioned by the hotel managers and chefs.

In the same context, the largest gap between customer expectation and perception was detected on “the presence of automatic electricity control in hotel” item in this study. This finding means that the hotel services that are related to efficient use of electricity were not capable of satisfying customer expectations. However in previous studies (c.f. Bastič and Gojčič, 2012; Raggi and Petti, 2006), efficient use of electricity is seen as one of the main eco-components in hotel services. Millar and Baloglu (2008) emphasize energy saving lighting when identifying green attributes preferences of customers in a hotel. Tseng and Hung (2013) find that the largest gaps existing between expectation and perception of customers were “the recyclability ratio” and the

“floor coverings are made from natural materials” items.

Third, the *quality plan scores* in the service providers’ perspective show the significant level for each customer expectation. The customer expectations identified as the most important ones by managers and service providers in this study are: presence of the hotel not causing any harm to the environment, compliance of hotel with surrounding nature, effective use of energy, presence of automatic electricity control, effective use of water, and lavatories containing automatic water saving systems. This shows that managers, as the planner of services, emphasize the effective use of energy along with environmental harmlessness and compliance, as found in previous research. Considering the largest gap between customer expectations and perceptions, this finding also demonstrates that managers are aware of the lack of effective use of energy systems in the hotel.

The *rate of level up* values identify the customer expectations that require an improvement in the views of customer and managers collectively. This study found that service designers at the hotel should focus relatively more on “the presence of automatic electricity control” since this expectation has the highest rate of level up. According to Millar and Baloglu’s (2011) finding, customers also mention energy and water issues as the top two environmental issues that the hospitality will face in the next five years. The customer expectation that needs the least improvement effort in this study is “having opportunity for buying ecological products”. Similarly, Bastič and Gojčič (2012) find that bio-food dimension of eco-component is ranked as the lowest dimension by the customers in their study.

In terms of *priority factors*, the highest scores were given to customer expectations that were related to compliance and harmlessness to environment, methods of effective use of energy, and food. This finding is an indication that managers estimate a link among expectations that are more likely to increase sales and sustainability.

According to the *relative weights* in the planning matrix, the most critical customer expectations in this study are (1) the presence of the hotel not causing any harm to the environment, (2) the compliance of hotel with surrounding nature, (3) the effective use of energy, (4) the presence of automatic electricity control, (5) the effective use of water, and (6) lavatories containing automatic water saving systems. This finding refers to the points on which customers and managers collectively focus to improve environmental sustainability in hotel industry. In terms of energy saving and effective use of water, Robinot and Giannelloni (2010) state that the reuse of linens and towels is a basic attribute of service expected by hotel customers. They also state that using clean and renewable energy sources is perceived by the customers as an additional positive service attribute.

Watkins (1994), Millar and Baloglu (2008), Erdogan and Baris (2007), Ahmad (2014), Berezan *et al.* (2013), Raggi and Petti (2006), Ayuso (2006) and Mensah (2006) emphasize using energy-efficient lights. Kasim (2004), Grosbois (2012), Tzschentke *et al* (2008), and Nayak and Singh (2013) mention the importance of water and energy saving.

As the last significant outcome of HOQ, the most important *technical requirements* were: (1) economic use of electricity and water saving systems, (2) use of natural material at hotel, and (3) adequacy of systems not harming environment and human. These technical requirements are identified as service delivery characteristics that meet customer expectations and improve environmental sustainability at hotels. Energy management strategies should have a priority in management agendas (Deng & Burnett, 2002; Pace, 2016). Raggi and Petti (2006), Rahmana *et al* (2012), Tari' *et al* (2010), and Min (2002), Kahn *et al.* (2016) also find energy and water saving as a major important factor in service delivery process of hotels. Energy consumption in hotels is identified as a competitiveness factor (Erdogan & Baris, 2007), and some previous studies in the literature emphasize the financial aspects and gains of appropriate and sustainable energy use (c.f. Bowe, 2005; Shiming & Burnett, 2002). Other studies report

that energy cost savings result in increased profitability, market share, and environmental sustainability (c.f. Deng & Burnett, 2002; Raggi & Petti, 2006), along the same lines as the Deming Chain Reaction.

Erdogan and Baris (2007) also emphasize that increasing sensitivity to environmental factors is crucial in hotel design activities. Unlike the manufacturing setting, environment is not only a production factor, but also a component of the service itself (Ostrom, Gardner, & Walker, 1994). Nayak and Singh (2013) find interiors of hotel and the materials used to be important variables in the underlying factors affecting the green marketing mix in hotel industry. Heikkinen (2009) states that hotels will more likely to adapt to natural environment in the near future. Parallel to the other technical requirements, "adequacy of systems not harming environment and human" has a huge potential to improve environmental sustainability, because this requirement is included in the core of sustainability definitions. As a strong support to this finding, this technical requirement has been identified as associated with all other technical requirements in this study. In a similar vein, Claver-Cortés *et al.* (2007) present the importance of environmental proactive systems and Mensah (2006) discusses environmental health and protection as a crucial concern for hotels. Bohdanowicz (2006) also mentions incorporating technical and behavioural practices in implementing environmental sustainability in hotels.

The impact of effective environmental management on corporate performance of hotels can be analysed in two areas. Management can directly improve their hotel's financial performance through creating competitive advantage by integrating environmental considerations into operational management. Management can also improve the competitiveness of a hotel destination by investing in quality of environment indirectly (Lopez-Gamero *et al.*, 2011; Hassan, 2000; Huybers & Bennet, 2003; Chen *et al.*, 2016). The findings of this study apply to both those areas. For example, while "compliance of hotel with surrounding nature" is related with investment of environmental quality, "effective

use of energy” and “presence of automatic electricity control” lead to impacts of environmental management on financial performance of the hotels.

Even though “effective use of energy, water or electricity” are perceived as well-known topics, studies indicate that this perception is not totally true. West and Elliot (1996) and Blank (1999) demonstrate that the percentage of hotels utilizing energy saving tools are between 10% and 25%, varying based on the size and age of hotel. The basic reason for this relatively low percentage may be because investment in the required equipment is costly (Rutes, *et al.*, 2001). Moreover, instead of cost savings through basic precautions in environmental operations (Jaffe *et al.*, 1995), there are other claims supporting the idea that environmental operations may result in high costs (Walley & Whitehead, 1994). The relationship between corporate environmental protection and economic performance does not present a stable trend. While some previous studies demonstrate a positive relationship between economic performance and environmental strategy (Russo and Fouts, 1997; Judge and Douglas, 1998; Klassen and McLaughlin, 1996; Oluseyi *et al.*, 2016), others indicate a negative relationship between the variables (Cordeiro and Sarkis, 1997; Worrell *et al.*, 1995). These findings suggest that it is not possible to generalize that hotels are more likely to increase economic performance as long as they improve their environmental awareness and operations. There are more variables affecting the result than just the environmental ones.

Previous studies in the hotel industry emphasize the benefits of differentiation as an important competitive advantage factor (Baum & Mezias, 1992; Garrigós-Simón *et al.*, 2008). Technological advancements, varying customer preferences, and intense competition guide hotel management toward an emphasis on differentiation, such as environmental management (Huybers & Bennett, 2002, 2003; Ritchie & Crouch, 2003). In a similar vein, Richter (2001) states that the firms that are interested in short-term profit focus solely on the cost aspect of environmental strategies.

However, the firms focusing on long-term goals are able to see the potential opportunities and the rationales of the environmental investments. Those firms that realize the opportunities of the environmental awareness, rather than such as threat, are more likely to have a competitive advantage (Friedman and Friedman, 2009).

In the Rio Earth Summit 1992, tourism was indicated as one of the essential sectors for sustainable national development. Following the Summit, environmental sustainability awareness has increased within the hotel industry and among relevant actors. The hotel industry should consider implementing environmentally-friendly innovation programs and policies to improve sustainability because of this increased awareness among all stakeholders. In hotels, service design processes should focus simultaneously on customer expectations and service providers' views. Han *et al.* (2011) and Belz (2006) suggest that environmental friendly hotel services should be accurately and effectively communicated to the target market and also to the general community.

Additionally, hotel management should apply environmentally responsible practices as effective and efficient marketing tools to inform and persuade customers to consider their hotel for future experiences. Leonidou *et al.* (2013) find that the effect of environmental friendly approaches on competitive advantage is significant in highly competitive markets. Due to the fact that the hotel industry is a highly competitive market, managers should utilize a combined approach, including customer expectations and manager views and experience while designing and developing environmentally sustainable services. Bohdanowicz (2006) discusses this point in detail, stating that environmental sustainability activities should be initiated by customer demands.

Since investments in environmental effectiveness have opportunity costs, the fact that customers have a parallel perspective with hotel management shows hotel managers which actions should be taken. In the hotel

industry, environmental quality and consumer perceptions of the quality have a special relationship (Hassan, 2000: 244). In essence, meeting and exceeding customer expectations support brand loyalty and positive word-of-mouth in service industries (Zeithaml *et al.* 1996). Also, perceived environmental quality affects customer attitudes (Mieczkowski, 1995). The nature of these services supports the customers' dynamic role in service delivery processes.

Customers develop collaborative attitudes towards environmental management operations, especially in waste management and resource consumption, when customer expectations about management's environmental strategies are taken into consideration. For example, customers may prefer to consume water and use towels more carefully during their visit. One of the other important factors includes the customers' consciousness of hotel environmental strategies. In the light of the findings of this study, the points on which customers pay more attention are related to well-known environmental management topics. However, when comparing customers' expectations and perceptions, a gap occurs between customers' expectations and perceptions. In this sense, training programs should be organised for all stakeholders, such as customers, employees and other community members, to increase environmental awareness (Trung & Kumar, 2005). Appropriate advertisements could greatly aid in this process.

As stated by Bonilla-Priego *et al.* (2011), the majority of hotel managers implement environmental practices because of legal regulations, instead of these practices being a synergetic part of corporate strategy (Chung & Parker, 2008). However, as explained in this study, environmental strategies at hotels should take improved sustainability into consideration by focusing on customer expectations and expert knowledge of managers, instead of only on their legal obligations.

The concept of environmental management in hotel industry is multifaceted (Carmona-Moreno *et al.* 2004). First, even though one particular

hotel has a relatively low impact on the environment, the entire industry is more likely to have a cumulative negative effect (Kirk, 1995). Second, the lack of legal regulations concerning environmental management in hotel industry can be seen, especially in developing countries. Third, the customers' dynamic role in service delivery processes might be another factor leading to further complexity. As a general implication, this study concludes that the harmony with nature and the protection of natural resources are the crucial factors that should be taken into consideration in service design processes for environmentally sustainable hotels.

The limitations and further research

As well as the strengths, the paper has some limitations. One of the potential limitations identified in this study is the fact that the QFD methodology could be run within an individual organisational setting. This point might be seen as a limitation. However, implementing QFD in one particular hotel setting may be seen as a factor to overcome the violation of the sample homogeneity. That being said, instead of measuring the general environmental expectation and perception of customers about the overall hotel services, regardless of the type of hotel, we evaluated customers' particular environmental expectations and perceptions regarding a spa hotel segment.

The other limitation may be seen as the sample size of the study. Statistically, higher sample size is more likely to have more power. Furthermore, the current study did not focus on the other service providers competing in the same market segment. Reaching the competitors' actual customers might have resulted in learning more information about the competitors to set a standard or threshold for the current hotel's service performance.

The current study presents a cross-sectional survey, not a longitudinal study. In another words, the data represents one point in time and the results include a static view. This point may be perceived as both a limitation and an opportunity for a further research. In further research, customers' views could be analysed as a trend by including different periods or points in time. In this sense, this approach may

increase confidence in the nature and power of the method.

In terms of future research, this study may integrate fuzzy logic into measuring the customers' perceptions and expectations. Fuzzy logic also may be integrated into managers' evaluations. Following a similar approach, all customer and manager evaluations might be weighted, as opposed to using the raw evaluation data. This study could also be implemented in different hotel settings such as city hotels or spas. Educational diversity of the customers participated in the research could also differentiate the environmental expectations.

Conclusion

In this study, QFD is implemented as a method simultaneously combining customer expectations and appropriate technical requirements, including service designers' points of view to improve environmental sustainability. Focusing on Deming Chain Reaction at the bottom line, QFD also is utilized as a tool to increase the performance of design activities to the sustainability of the organisations. This study also supports the competitiveness of hotels, as a necessary factor for sustainability, by integrating customer and service providers' environmental perceptions into innovative service design and delivery processes. More specifically, the environmental approach has been integrated into the definition of competitiveness in the tourism industry (Yoon, 2002).

The tourism industry needs sustainable improvement (Kirk 1996). The community's positive view of environmental concern, legal regulations, customers' pressure, and financial benefits of environmental strategies are basic sources of motivation for environmental concerns (Kirk, 1995; Santana-Jiménez *et al.*, 2013). The hotel industry will be less sustainable and individual hotel survivability will decrease if they neglect their environmental responsibilities (Tzschentke *et al.*, 2008). Hassan (2000: 244) states that "environmental commitment will be the forefront issue for the economic revitalization of the tourism industry". Considering the high pressures exerted legally

and socially by all related stakeholders in the hotel industry, environmental sustainability is a current challenge for both customers and service providers. Firms in the tourism industry that are not compatible with environmental integrity cannot survive in the long run (Hassan, 2000).

To improve environmental sustainability level in this industry, hotel management should have a systematic and integrated service design processes that involve not only the managers' expert knowledge, but also customer expectations. Service firms benefit from research, models, and methods employed by manufacturing firms when shaping environmental policies (Foster *et al.*, 2000). Hsiao *et al.*, (2014), Webster (2000), Erdogan and Baris (2007), and Kasim (2007) suggest that environmental awareness related strategies have a strong association with sustainability in hotels.

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