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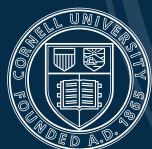
Exploring the Relationship between
Eco-certifications and Resource Efficiency in U.S. Hotels

by Jie J. Zhang, D.B.A., Nitin Joglekar, Ph.D.,
Rohit Verma, Ph.D., Janelle Heineke, D.B.A.

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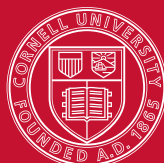
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EXECUTIVE SUMMARY

This study examines the impact of eco-certifications on two aspects of resource efficiency in hotel operations—operational efficiency and guest-driven efficiency. We analyze the effect of the Travelocity.com’s ecoleaf label, which designates hotels that have received eco-certification from any of several organizations. To earn the ecoleaf, the certification must be from a second or third party and must be available for audit. We analyze the relationship between eco-certifications and resource efficiency driven by both operations and customers. Using a large scale dataset from PKF Hospitality Research on the U.S. hotel industry, we found that eco-certified hotels recorded higher operations-driven and customer-driven resource efficiency. While the specific ratios vary according to a hotel’s chain scale, it’s clear that this group of U.S. hotels benefited from earning certification.

Keywords: Eco-certification, resource efficiency, service coproduction, environmental sustainability

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Acknowledgments. The authors wish to thank the Cornell Center for Hospitality Research (CHR) and PKF Hospitality Research (PKF-HR) for their invaluable industry insights and data access.

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Even as an increasing number of hotels (and other hospitality firms) achieve certification for environmentally sound or sustainable practices, the jury remains out on whether such “eco-certifications” attract more customers.¹ However, we and other researchers have identified a benefit of eco-certification for hotels. Empirical evidence has shown that hotels gain improved operational efficiency in connection with eco-certifications.² What has been less clear is what effect eco-certification has on the behavior of customers who stay at a certified hotel. This is an important question, because without customers on board, hotels cannot gain the full value of the eco-certification, in terms of conserving resource use. In this regard, hotels may face challenges in achieving their environmental goals because operations and customers are both drivers of environmental sustainability of hotel properties.³

¹ Claudia Lübbert, “Tourism Ecolabels Market Research in Germany,” in *Tourism Ecolabelling: Certification and Promotion of Sustainable Management*, ed. Xavier Font and R. C. Buckley (Wallingford: CAB International, 2001); Xavier Font, “Environmental Certification in Tourism and Hospitality: Progress, Process and Prospects,” *Tourism Management* 23 (3) 2002: 197–205; Axel Reiser and David G. Simmons, “A Quasi-Experimental Method for Testing the Effectiveness of Ecolabel Promotion,” *Journal of Sustainable Tourism*, Vol. 13 (November 2005), pp. 590–616; doi:10.1080/09669580508668583; Ralf Buckley, “Social-Benefit Certification as a Game,” *Tourism Management*, Vol. 37 (2013): 203–209; doi:10.1016/j.tourman.2013.01.004; Michelle Esparon, Emma Gyuris, and Natalie Stoeckl, “Does ECO Certification Deliver Benefits? An Empirical Investigation of Visitors’ Perceptions of the Importance of ECO Certification’s Attributes and of Operators’ Performance,” *Journal of Sustainable Tourism*, Vol. 22, No. 1 (2014), pp. 1–22; doi:10.1080/09669582.2013.802325; and Howard Chong and Rohit Verma, “Hotel Sustainability: Financial Analysis Shines a Cautious Green Light,” *Cornell Hospitality Report*, Vol. 13, No. 10 (2013); Cornell Center for Hospitality Research: www.hotelschool.cornell.edu/research/chr/pubs/reports/abstract-17463.html.

² Jim Butler, “The Compelling ‘Hard Case’ for ‘Green’ Hotel Development,” *Cornell Hospitality Quarterly*, Vol. 49, No. 3 (August 2008), pp. 234–244. doi:10.1177/1938965508322174; and Ángel Peiró-Signes, Rohit Verma, and Luis Miret-Pastor, “Does Environmental Certification Help the Economic Performance of Hotels? Evidence from the Spanish Hotel Industry,” *Cornell Hospitality Quarterly* Vol. 53, No. 3 (August 2012), pp. 242–256.

³ Jie J. Zhang, Nitin R. Joglekar, and Rohit Verma, “Exploring Resource Efficiency Benchmarks for Environmental Sustainability in Hotels,” *Cornell Hospitality Quarterly*, Vol. 53, No. 3 (2012), pp. 229–241.

The initial findings are promising. Product-related research has shown that the good practices stipulated in eco-certification criteria bring both an operational and price premium by improving process and product quality.⁴ The picture is not as clear in service settings, however, as eco-certification's influence on customers' behavior is not sufficiently understood. Research has examined the impact of eco-certifications on customers' perceptions of hotels, but not how they react in terms of behavior once they have checked in.⁵ With regard to operations, one study found an overall positive link between environmental performance and operating performance,⁶ and a study of Spanish hotels found empirical evidence of a positive link between financial performance and eco-certification.⁷ In this report we examine the underlying drivers of these links. We argue that a key mechanism by which eco-certifications influence operations and customers is by guiding their resource consumption behavior. Using archival data consisting of annual operating statements and eco-certification information, we measure and test the effect of that influence. Our study addresses the following two questions:

- (1) Are eco-certified hotels more efficient in operations-driven resource efficiency, after controlling for hotel size, occupancy rate, star rating and property type?; and
- (2) Similarly, are eco-certified hotels more efficient in customer-driven resource efficiency (with the same controls)?

In answer to those questions, we found that eco-certified hotels maintain higher overall efficiency in resource use that is driven both by operations and by customers. As we explain below, our results suggest that eco-certifications influence the resource consumption behavior of both the operators and the customers.

This research advances the understanding of how eco-certifications drive sustainable hospitality operation. The study also contributes to the broader discussion of the economic, environmental, and social performance of businesses—the so-called “triple bottom line.”⁸ It appears that by announcing conformance to environmental stewardship criteria to outside stakeholders through an eco-certification, hotels can potentially steer guests' use of natural resources, and possibly also increase demand by more environmentally friendly customers. We note, however, that the benefits of eco-certification do not fall evenly on hotels in different star rating groups or property types.

In this report, we first review prior research on eco-certification and resource efficiency benchmarking. We then describe our research design and analysis approach, followed by results and discussions of their implications. Finally, we discuss theoretical and managerial insights of this study.

Eco-certifications and Resource Efficiency in Hotels

Eco-certifications can influence resource efficiency in two ways. First, the operations of the eco-certified organization must conform to the guidelines of the certification agency.

⁴ Dennis Rondinelli and Gyula Vastag, “Panacea, Common Sense, or Just a Label?: The Value of ISO 14001 Environmental Management Systems,” *European Management Journal*, Vol. 18, No. 5 (2000), pp. 499–510; Magali A. Delmas and Laura E. Grant, “Eco-Labeling Strategies and Price Premium: The Wine Industry Puzzle,” *Business & Society*, Vol. 53, No. 1 (2014), pp. 6–44; A.A. King, M.J. Lenox, and A. Terlaak, “The Strategic Use of Decentralized Institutions: Exploring Certification with the ISO 14001 Management Standard,” *Academy of Management Journal*, Vol. 48 (2005), pp. 1091–1106.

⁵ For example, see: Michelle Millar and Seyhmus Baloglu, “Hotel Guests' Preferences for Green Guest Room Attributes,” *Cornell Hospitality Quarterly*, Vol. 52, No. 3 (August 2011), pp. 302–311; and Esparon, Gyuris, and Stoeckl, *op.cit.*

⁶ Jie J. Zhang, Nitin R. Joglekar, and Rohit Verma, “Pushing the Frontier of Sustainable Service Operations Management: Evidence from US Hospitality Industry,” *Journal of Service Management* Vol. 23, No. 3 (2012), pp. 377–399.

⁷ Peiró-Signes, Verma, and Miret-Pastor, *op.cit.*

⁸ John Elkington, *Cannibals with Forks: The Triple Bottom Line of 21st Century Business* (UK: Capstone, 1997).

Given that there are many such certifications, we cannot generalize about exactly what a hotel must do to earn a particular certification, but a typical action is to install resource efficient technologies such as energy- and water-efficient appliances. Ironically, actual improvement in resource efficiency cannot always be assumed, although that is usually the result. A counterintuitive phenomenon discovered by economists is that technological progress that increases resource efficiency tends to increase the rate of consumption of that resource, a situation known as the Jevons paradox.⁹ For example, in a hotel setting, the potential resource savings from installing low flow showerhead could be offset by extremely lengthy showers.

Second, consumers' responses to eco-certifications remain a mixed picture. Studies of eco-certification as a green selling tool, for instance, have been unable to document increased sales volume,¹⁰ and one study declared the industry-wide effects of implementing sustainability programs to be revenue neutral.¹¹ In the hospitality industry, in spite of survey evidence of customers' more favorable perception of eco-certified hotels, empirical evidence has not shown that those hotels win customers solely because of eco-certification.¹² However, the lack of firm evidence of increased patronage does not necessarily indicate that customers are indifferent to eco-certifications. We argue that the informational effect of eco-certification goes beyond what is captured in the customers' willingness-to-stay statistics. We also need to measure the effects of certification on what happens during the hotel stay, since that also has significant environmental impact.

To accomplish the goal of informing outside stakeholders, eco-certifications need to meet certain conditions, including broad acceptance, openness, communication, and the availability of an independent audit.¹³ In reality, however, a certain level of noise surrounding eco-certifications is unavoidable, in part because each certifying agency has a different set of

standards.¹⁴ Another source of inconsistency could occur when an agency mistakenly certifies a firm as environmentally friendly, or an environmentally friendly firm finds certification impractical. If one adds customer skepticism to the noise surrounding certification, it's not a surprise that customers' responses can be quite uneven. In the hotel industry for example, environmentally conscious customers may use the information to seek out eco-certified hotels, while other customers may become frustrated with the noise and view eco-certified hotels in a negative light. This is one source of concerns about "greenwashing."

Given this murky situation, understanding the impact of eco-certification on a hotel's resource efficiency requires us to consider environment-focused operational procedures and choices customers make during their hotel stay. To shed light on these issues and evaluate the overall effect of eco-certifications on resource efficiency, we compare resource use in eco-certified hotels to "other" hotels, those that are not so certified. Eco-certified hotels are those that are certified by third parties that have no vested interest in the outcome or by second-party purchasing or trade organizations that have an interest in being perceived as offering a legitimate certification. Both second- and third-party certifiers in this instance guarantee an audit of their certification decisions. The "other" group of hotels are those that are uncertified, self-certified, or certified by second parties without outside verification. We chose to compare resource use, because when customers actively participate in the production of the service, their consumption behavior matters as much as the service provider's operational decisions.¹⁵ To this end, we use a two-factor measure derived from yearly resource consumption data in annual operating statements to measure and compare customers' and operational resource efficiency in the two sets of hotels.¹⁶

⁹ Blake Alcott, "Jevons' Paradox," *Ecological Economics*, Vol. 54, No. 1 (2005), pp. 9–21. doi:10.1016/j.ecolecon.2005.03.020.

¹⁰ Jill M. Ginsberg and Paul N. Bloom, "Choosing the Right Green Marketing Strategy," *MIT Sloan Management Review*, Vol. 46 (2004), pp. 79–84; Ken Peattie and Andrew Crane, "Green Marketing: Legend, Myth, Farce or Prophecy?," *Qualitative Market Research: An International Journal*, Vol. 8, No. 4 (2005), pp. 357–370; Emma Rex and Henrikke Baumann, "Beyond Ecolabels: What Green Marketing Can Learn from Conventional Marketing," *Sustainable Production and Consumption: Making the Connection*, Vol. 15, No. 6 (2007), pp. 567–576. doi:10.1016/j.jclepro.2006.05.013; Philip Sloan, Willy Legrand, and Joseph S. Chen, *Sustainability in the Hospitality Industry: Principles of Sustainable Operations* (U.K.: Routledge 2009).

¹¹ Chong and Verma, *op.cit.*

¹² Esparon, Gyuris, and Stoeckl, *op.cit.*

¹³ Buckley, *op.cit.*; Font, *op.cit.*; Tim Coles, Emily Fenclova, and Claire Dinan, "Tourism and Corporate Social Responsibility: A Critical Review and Research Agenda," *Tourism Management Perspectives*, Vol. 6 (2013), pp. 122–141,

¹⁴ Mason, *op.cit.*

¹⁵ Richard B. Chase, Gregory B. Northcraft, and Gerrit Wolf, "Designing High-Contact Service Systems: Applications to Branches of a Savings and Loan," *Decision Sciences*, Vol. 15 (1984), pp. 542–556. doi:10.1111/j.1540-5915.1984.tb01241; S. Thomas Foster, Jr., Scott E. Sampson, and Steven C. Dunn, "The Impact of Customer Contact on Environmental Initiatives for Service Firms," *International Journal of Operations & Production Management*, Vol. 20 (2000), pp. 187–203; Scott E. Sampson and Craig M. Froehle, "Foundations and Implications of a Proposed Unified Services Theory," *Production and Operations Management*, Vol. 15, No. 2 (2006), pp. 329–343; and Zhang, Joglekar, and Verma (*Cornell Hospitality Quarterly*) *op.cit.*

¹⁶ Jie J. Zhang, Nitin R. Joglekar, and Rohit Verma, "Developing Measures for Environmental Sustainability in Hotels: An Exploratory Study," *Cornell Hospitality Report*, Vol. 10, No. 8 (2010); Cornell Center for Hospitality Research.

Travelocity's green leaf tag identifying eco-certified hotels

The image shows a screenshot of the Travelocity website interface. On the left, there is a sidebar with filters. Under 'Accommodation Type', the 'Green / eco friendly (1)' option is selected and circled in green. The main search results area shows a list of hotels. The first result is 'YOTEL New York at Times Square West' with a green leaf tag labeled 'Eco-Friendly Hotel' circled in green. Below it, another result for 'Hilton Minneapolis' also has a green leaf tag labeled 'eco-leaf symbol' circled in green. At the bottom, there is a section titled 'The Travelocity Green Guarantee' which explains that Travelocity offers the largest Green Hotel Directory and works with rigorous second- and third-party certification programs to certify their Green Hotels. It includes a green leaf icon and text stating: 'Just look for our green leaf tag when you shop on our site, and rest assured that it's a symbol you--and the Earth--can trust.'

Hypotheses

Although research has found empirical evidence of financial performance benefits from eco-certifications for hotels,¹⁷ we also found the possibility of the negative “greenwashing” relationship that we mentioned above, given the noisy context, customer confusion, and complex interplay between efficiency technology adoption and consumption behavior changes. Cutting through this noise, we propose that “eco-certified” hotels can achieve more efficient resource usage by both operations and customers than hotels in the “other” category.

With regard to operations, audits and second- or third-party accreditation contribute to more scrutiny and fewer chances for false designation, and ensure that environmentally friendly hotels are more likely to meet the criteria and

¹⁷ Peiró-Signes, Verma, and Miret-Pastor, *op.cit.*

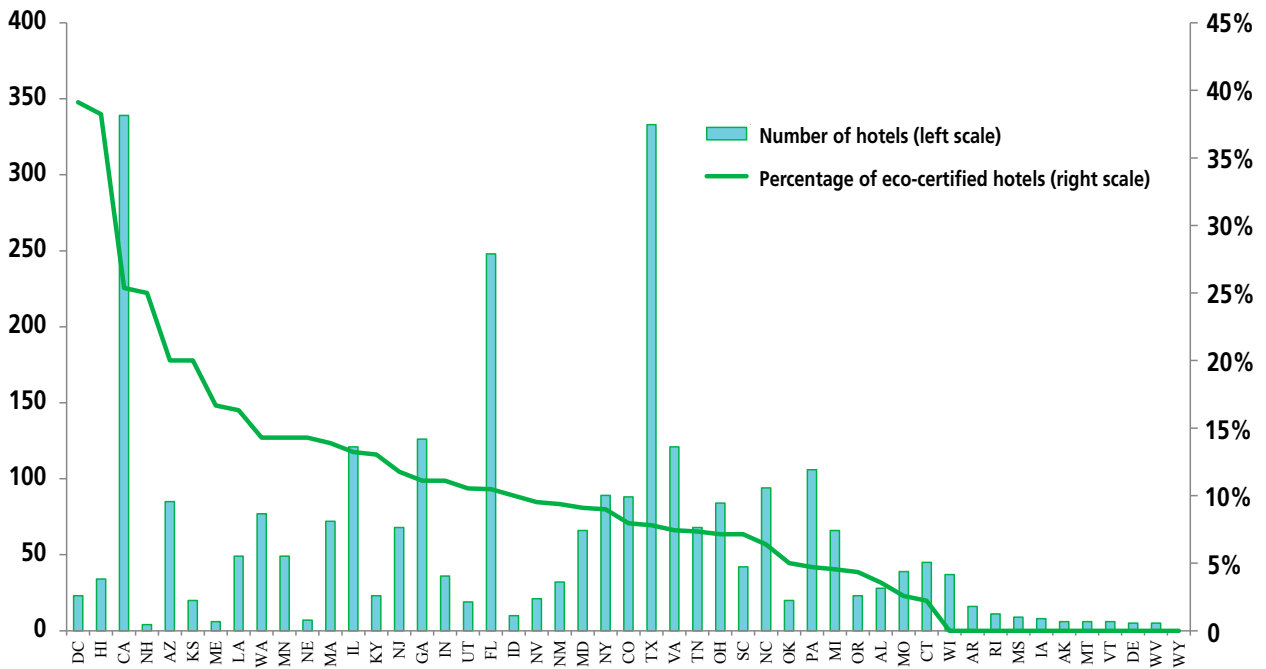
become certified.¹⁸ Therefore, if we compare the operations-driven resource efficiency factors in eco-certified hotels versus the others, eco-certified hotels should have higher operations-driven resource efficiency.

Hypothesis 1: Eco-certified hotels have higher operations-driven resource efficiency.

With regard to guest actions, the information conveyed by second- and third-party eco-certifications with guaranteed audits suffers less noise and therefore results in less confusion. Such eco-certifications may be more effective in influencing customers by attracting customers that are more eco-friendly (possibly influencing the willingness-to-stay decision), or affecting resource consumption during their stay through education or enabling mechanisms. For example, Leadership in Energy and Environmental Design (LEED)

¹⁸ Mason, *op.cit.*

Sample distribution by state and percentage of eco-certified hotels



certification provides a particular type of recognition,¹⁹ in addition to requiring energy efficient ventilation, cooling and lighting systems and more convenient recycling mechanisms that enable customers to conserve and recycle. Therefore, we hypothesize that:

Hypothesis 2: Eco-certified hotels have higher customer-driven resource efficiency.

We include several contextual variables in the model to control for alternative explanations of the observed variation in resource efficiency, including hotel size, occupancy rate, star rating, and property type, as follows.

Hotel size (number of rooms) may affect resource efficiency due to overhead. For example, larger hotels have more rooms, as well as more public space. The temperature of much of this space must be regulated whether the rooms are occupied or not, and this may interfere with operations-driven resource efficiency. The net effect of hotel size on customer-driven resource efficiency is not clear, however, as

there are potential savings from ordering large quantities of supplies, for instance.

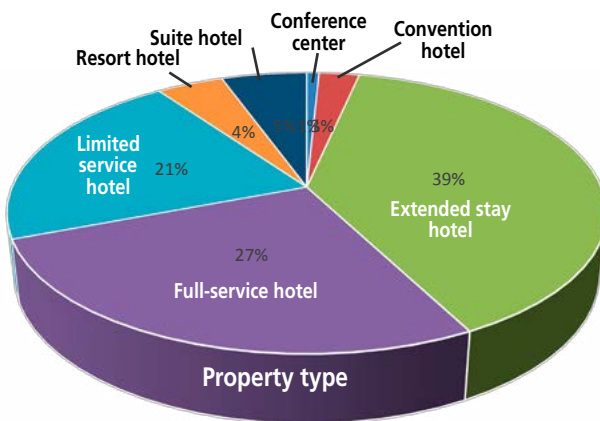
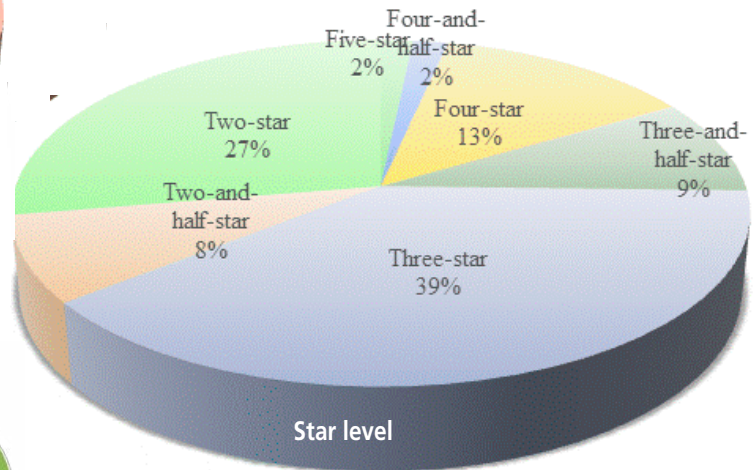
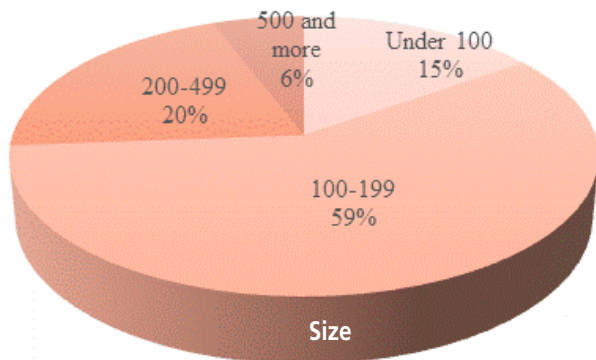
Occupancy rate can affect resource efficiency, since fixed costs are spread over more customer volume as occupancy rises. Fixed costs such as resource expenditures driven by operations constitute a smaller portion per dollar of revenue generated as occupancy rate increases. However,

About the PKF Hospitality Research Survey

PKF Hospitality Research (PKF-HR) has collected annual operating statements from thousands of hotels across the United States since the 1930s, reporting over 200 revenue and expense items in their proprietary *Trends in the Hotel Industry* database. Participation in the survey is voluntary. Every year, after receiving the survey forms or copies of December profit and loss statements, PKF-HR enters all the data in accordance with the classification system prescribed by the most current edition of the *Uniform System of Accounts for the Lodging Industry* (USALI).

¹⁹ Millar and Baloglu, *op.cit.*

Sample characteristics



even variable expenses can have fixed components.²⁰ For example, guest supplies are traditionally considered variable expenses, but a minimum quantity of supplies must be purchased to operate the hotel regardless of the occupancy rate. So we expect a positive relationship between resource efficiency and occupancy rate.

Amenities and services offered by hotels at different star rating levels and various property types also have a large impact on the resource consumption. For example, food and beverage, and pool or spa amenities can have strong impact on resource consumption. The implementation of eco-certifications often involves careful documentation and monitoring of current processes, which helps uncover wasteful activities hidden in complex operations. We expect that hotel properties with a wide range of offerings, such as convention centers and resorts, will have more opportunities for efficiency improvement through eco-certification.

²⁰ Aaron Walls and Jamie Lane, "The Fixed Component of Variable Hotel Expenses and the Variable Component of Fixed Expenses," *2011 Trends Expense Article* (2011); www.pkf.com/en/pkf-hr/PublicationsAndData/Trends/2011trendsexpensearticle.aspx.

Methodology

This research focuses on the resource consumption driven by hotel operations and by customers, taking into account customers' awareness of eco-certifications. While there are numerous certifications, all of them have at least some consistency by requiring data on consumption of key resources (water, electricity, and materials) in internal operations. Our study matches hotel properties with eco-certification and without such certification from two data sources. The first set of data came from a 2011 operating statement survey by PKF Hospitality Research (PKF-HR), completed in early 2012 (as shown in the accompanying box). We collected the second data set between February and April 2012.

Rather than search out numerous certifications, we used the eco-hotel designation by Travelocity.com, as indicated by the eoleaf symbol on its website. Exhibit 1 shows the eoleaf designation on Travelocity's hotel description pages. The "other," non-certified hotels are those without the eoleaf symbol. Eoleaf is not an eco-certification *per se*, but represents a basket of eco-certifications. Travelocity only tags hotels with a green leaf symbol if they are certified

Regression results related to operations efficiency (ODF) and customer efficiency (CDF)

Variables	Model 1 - ODF as D.V. Effect on Operations-driven Resource Efficiency	Model 2 - CDF as D.V. Effect on Customer-driven Resource Efficiency
Ecoleaf	+	+
Occupancy	+	+
Hotel Size	-	Not significant
Star Rating Dummies	See Exhibit 5 for illustration of the effects.	
Property Type Dummies	See Exhibit 6 for illustration of the effects.	

by second- and third-parties whose standards closely align with the Global Sustainable Tourism Criteria (GSTC) and who can guarantee an audit.²¹ Showcasing this information on one of the largest online travel agency websites clearly indicates the intention of an eco-certified hotel to inform customers about the environmental characteristics of its processes and services.

Sample and Analysis

The sample resulting from combining the two data sources consists of 2,894 hotel properties in 48 U.S. states (plus the District of Columbia, or Washington, D.C.). The bars in Exhibit 2 indicate the number of hotel properties by state and the line represents the percentage of eco-certified hotels for each state. The sample, which is representative of the hotel distribution in the U.S., shows significant variation in the eco-certified hotel percentage across the states. Not surprisingly, the eco-certified hotel percentage is higher for areas with more progressive environmental regulation (e.g., Washington, D.C., and California), and those highly dependent on the natural environment (e.g., Hawaii). Exhibit 3 shows the summary statistics of the variables. The sample average occupancy rate is 70 percent. We log transformed the number of rooms to correct for skewness.

We adopt the resource efficiency benchmarking method detailed in Zhang et al.²² to derive the standardized scores of each hotel's resource efficiency driven by hotel operations and by customers. Primary resource expenses, including electricity, water, and sewer, as well as various

supplies consumed in the Rooms Department, Food and Beverage (F&B) Department, and Maintenance and Engineering Department, are normalized by revenue per available room (RevPAR) before entering the exploratory factor analysis (EFA). The EFA results are consistent with our 2010 CHR report.²³ As before, two factors emerge—an operations-driven factor (ODF) and a customer-driven factor (CDF). We predict the factor scores by using the factor loadings to calculate a weighted sum of the five primary resource expenses. The factor scores, which are normalized with the mean at zero, measure the resource efficiency along the operations and customer dimensions. A lower score means that fewer resources are consumed per dollar of revenue, meaning that lower scores correspond to higher resource efficiency.

We then use regression analysis to study the two resource efficiency measures as the dependent variables. The model specification is as follows:

Model 1: $ODF=f(\text{ecoleaf}, \text{size}, \text{occupancy rate}, \text{star rating}, \text{property type})$

Model 2: $CDF=f(\text{ecoleaf}, \text{size}, \text{occupancy rate}, \text{star rating}, \text{property type})$

Results

We found that eco-certified hotels generally have higher resource efficiency on both the operator and the customer factors. The evidence from the sample supports both Hypotheses 1 and 2, as indicated by the regression results shown in Exhibit 4. The dependent variable of model 1 is operations-driven resource efficiency (ODF), and for model 2, it is customer-driven resource efficiency (CDF). The plus signs in the table indicate that an increase in the variable is

²¹ Travelocity, "Green Hotels," 2011; www.travelocity.com/TravelFor-Good/gr-directory.html.

²² Zhang et al., *Cornell Hospitality Report; Cornell Hospitality Quarterly, op.cit.*

²³ Zhang, Joglekar, and Verma, *Cornell Hospitality Report, op.cit.*

Comparison of resource efficiency measures on seven star-rating groups: operations efficiency (ODF) and customer efficiency (CDF)



associated with an increase in the corresponding resource efficiency measure, and the negative sign indicates that a decrease in the variable is associated with a decrease in the resource efficiency measure. For both models, the coefficient estimates for the eco-certified hotel indicator variable “eco-leaf” are statistically significant and negative, meaning that eco-certified hotels have lower standardized scores on both the operator and the customer factors.

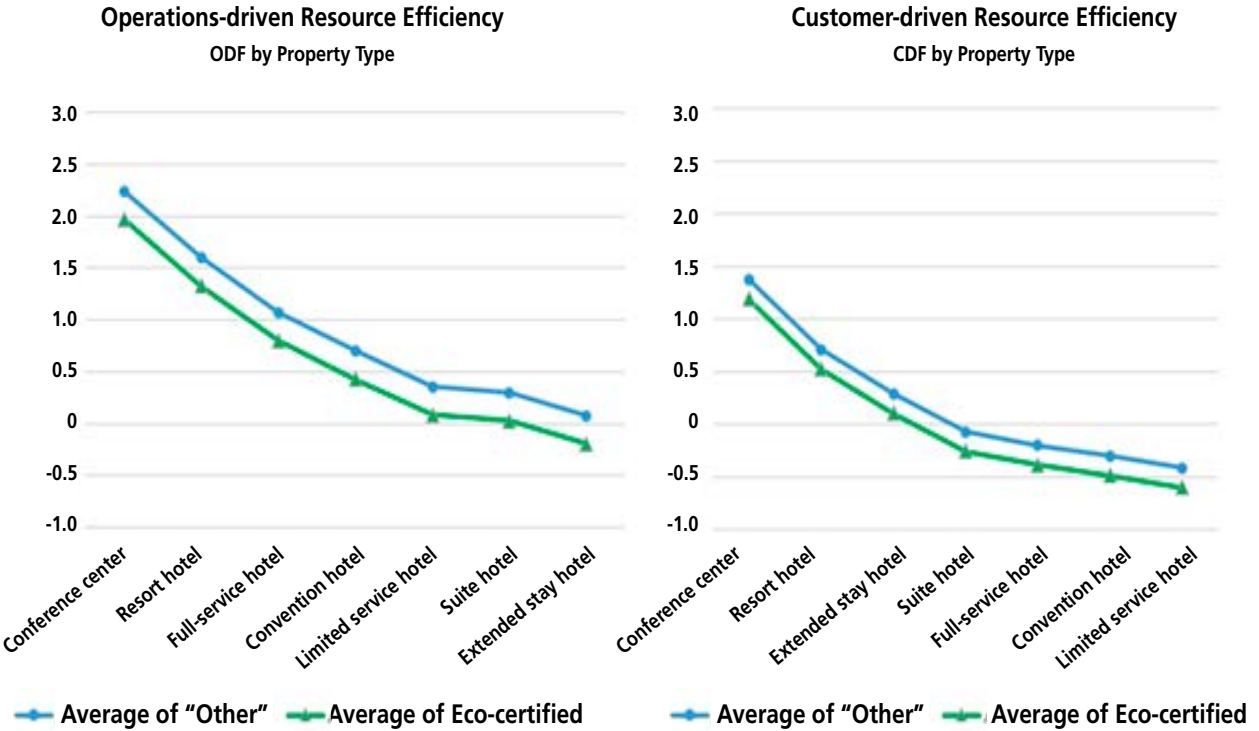
Even considering the contextual variables (size, occupancy rate, star rating, and property type), eco-certified hotels achieved higher operations-driven and customer-driven resource efficiency. As expected, occupancy rate has a positive relationship with both resource efficiency measures. Hotel size diminishes operations-driven resource efficiency, but has no statistically significant effect on customer-driven resource efficiency.

We found a diversity of findings when we examined the hotel subgroups based on star ratings and property type, as shown in Exhibits 5 and 6. The values along the y-axis are predicted resource efficiency measures based on the regression models, with the other variables at their sample means. In these exhibits, the green lines represent the resource efficiency scores of eco-certified hotels and blue lines represent those of the non-certified, “other” hotel properties. The

resource efficiency measures are standardized and a lower score means higher efficiency.

Although eco-certified hotels achieve higher operations- and customer-driven resource efficiency in all cases, the relationship of operations-driven and customer-driven factors changes in different hotel categories. Exhibit 5 compares the predicted resource efficiency scores for the operations-driven (left) and customer-driven (right) factors across seven star rating groups. There are two contrasting patterns of resource efficiency variation across the star rating groups: the operations-driven resource efficiency increases as the star rating rises, while the customer-driven resource efficiency generally decreases as the star rating rises. This could be related to the cost structures of hotels in different star rating groups. For example, despite high expenses from offering amenities such as F&B and pool or spa services, resource expenses per dollar of revenue generated constitutes a smaller percentage for hotels at the high end. Even though economy hotels provide limited amenities, in contrast, they charge a rock-bottom rate. Resource expenses per dollar of revenue generated can still be high, resulting in low operations-driven resource efficiency for hotels with lower star ratings. Note that the two-star hotels are also among the less efficient on the customer-driven resource efficiency side.

Comparison of resource efficiency measures on seven property types: operations efficiency (ODF) and customer efficiency (CDF)



Note: A lower value in the Y axis indicates higher efficiency.

Cost structure difference, however, does not explain all the variations we observe. For example, five-star hotels achieved the highest operations-driven resource efficiency, but the lowest in the customer-driven dimension. This pattern might be the result of an environmental strategy that emphasizes efficiency in back-office operations but customer satisfaction in the front of the house. An interesting future study could examine whether hotels in certain star rating groups focus more on eco-certification guidelines that affect operations only.

Exhibit 6 compares the predicted resource efficiency measures across seven hotel property types. We sort the data by the factor scores for eco-certified hotels to aid pattern identification. There are two observations. First, hotel properties offering more amenities and functions, including conference centers and resort hotels, lag in both efficiency measures. This suggests that these properties stand to benefit the most from implementing eco-certification. Second, we again observe differences in the ODF and CDF between-

group comparisons. For example, extended stay hotels are the most efficient in operations-driven factor, but hover around average on the customer-driven side.

Discussions and Future Research

A primary purpose of eco-certificates is customer awareness. Our study found that eco-certifications conforming to higher standards (i.e., audit-ready second- or third-party certifications) are associated with better environmental performance than self-certification or none at all (Exhibit 4). This finding underscores the credibility of audit-worthy eco-certifications accredited by second- and third-parties, and provides further empirical evidence for operational benefits of eco-certifications.

Despite this general phenomenon of greater efficiency for certified hotels, we found uneven effects related to eco-certifications on the operations across star ratings and property types (Exhibits 5 and 6). Possible explanations for such variations include: (1) the criteria stipulated in eco-certifications vary widely; and (2) hotels may apply their

idiosyncratic characteristics (e.g., location, amenities, and functions) to favor certain guidelines. For LEED certification, for instance, hotels can gain points in six different categories. Depending on factors such as location and building plan, the hotel owner may decide to focus on some of those six categories but not the others. For these reasons, inconsistent effects may manifest in the aggregate resource consumption outcome.

One promising finding is that customers seem to respond to eco-certification, as demonstrated by consistently higher customer-driven resource efficiency for eco-certified hotels in this study (Exhibits 4, 5, and 6). This finding does not resolve the puzzle of customers' apparent indifference to eco-certifications in terms of booking a hotel,²⁴ which could be an artifact of perceiving eco-certification merely as a green selling tool. Our findings offer some hope to hoteliers, since eco-certification seems to attract more environmentally friendly customers, educates customers about being more environmentally friendly, and provides mechanisms to enable customers to become green co-producers, all of which may contribute to the increase in customer-driven resource efficiency.

These findings are generalizable to tourism and other service industries where the benefits of informing stakeholders are seen after the purchase is made due to the collaborative efforts required in the operations. This includes institutions of higher education that are pursuing eco-certifications, for example. Eco-certifications are likely to have little influence on prospective students' choice of schools. However, the information conveyed through various communication channels and facility modifications will encourage behavior changes once the students matriculate.

Managerial Implications

Hoteliers who are serious about environmental credibility should pursue eco-certifications that accredit through second- and third-parties and can be audited. While we cannot make any statement about competitive advantage in this regard, we can say that the economic benefit comes not only from operational improvements by conforming to the eco-certification guidelines, but also from customers' contribution to improving resource efficiency.

It seems clear that the industry should coalesce behind a few, trustworthy eco-certification approaches, rather than the many diverse certifications that are in use, in part to improve the information being imparted to guests. With a critical mass behind trustworthy eco-certifications, the industry could develop uniform criteria and generate more

²⁴ Buckley, *op.cit.*; Font, *op.cit.*; Ralf Buckley, "Social-Benefit Certification as a Game," *Tourism Management*, Vol. 37 (2013), pp. 203–209; doi:10.1016/j.tourman.2013.01.004; and Esparon, Gyuris, and Stoeckl, *op.cit.*

comparable effects. This would further reduce the confusion and miscommunication between firms and customers. With high credibility and consistent criteria, eco-certifications can deliver the promise of being an effective alternative to the regulatory tools for improving the environment.²⁵

This report has focused on efficiency, but we are well aware that a hotel's operating context affects operating expenses. Important though it is, resource efficiency is but one aspect of a hotel's operational choices. As shown in Exhibit 5, hotels in the high star rating group achieve high efficiency in their operations but lag in customer-driven resource efficiency. Our data cannot tell us whether this was intentional or a missed opportunity, given upscale hotels' amenities and services.

More important, the strong positive customer-driven resource efficiency effect from eco-certifications underscores the importance of transparency in managing eco-certification programs, so that guests can observe the hotel's genuine environmental efforts. To achieve high transparency in operations, it is important for the managers themselves to understand the resource implications of various business activities through information gathering and benchmarking. For example, environmental management programs such as the "Green Engage"²⁶ (InterContinental Hotels Group) and "LightStay"²⁷ (Hilton Worldwide) monitor, measure, and compare the environmental impact of hotel operations. Aided by these programs, managers can understand not only the big picture of resource efficiency, but also the contribution of various partners and stakeholders—chief among these being the guests. Including the contribution breakdown information in the communications with stakeholders and sharing the savings with them proves commitment and constitutes the ultimate verification of the credibility of the firm's eco-certification.

²⁵ Mason, *op.cit.*

²⁶ The InterContinental Hotels Group describes the Green Engage program on the company website: "Green Engage is our comprehensive online sustainability system. It tells our hotels what they can do to be a 'green' hotel and gives them the means to conserve resources and save money—by measuring, managing and reporting on their hotel energy, water and waste consumption, as well as benchmarking and the ability to create action plans to track progress. We believe this offers a huge advantage to owners for whom energy is the second largest cost in their hotels. It also puts us in a strong position to respond to rising energy prices and any future carbon taxes IHG and our hotels may face." www.ihgplc.com/index.asp?pageid=742, viewed on August 19, 2013.

²⁷ The Hilton Worldwide describes the LightStay program on the company website: "LightStay is our proprietary system of measurement. It calculates sustainability performance impact across our global portfolio of hotels. LightStay delivers value to hotel owners without any additional cost. The system's data is used to improve the guest experience and drive economic returns." www1.hilton.com/ts/corporate/aboutus/aboutlightstay.htm, viewed on August 19, 2013.

Future Research

This study suggests that researchers should reopen the question of the relationship between eco-certification and hotel sales and pricing. This study found diverging patterns between star rating and resource efficiency measures (Exhibit 5). Given that research has found evidence of a price premium for eco-certified goods,²⁸ future studies can explore whether (and when) similar price premiums occur in service settings, and particularly in the hotel industry. Together with what we have learned regarding resource expenditures, this information will advance the knowledge about the underlying mechanisms that link eco-certification and economic performance.

Second, there are opportunities for different methodologies to investigate exactly how eco-certification affects customers' resource efficiency. It would be worth knowing whether the resource efficiency gains recorded here arise from attracting a distinct group of "green" customers or whether the certification causes "ordinary" customers to behave in a more environmentally responsible manner. Experimental designs such as choice modeling are excellent methods to study these questions as they are capable of teasing out confounding factors.

Conclusion

We believe this paper is the first within the hospitality field that explores the impact of eco-certifications by considering the efficiency of internal operations and customers at the same time. The findings provide empirical support for the two hypotheses that propose positive links between eco-certifications and the operations- and customer-driven resource efficiency. The successful implementation of eco-certifications requires hoteliers to carefully consider their operating contexts. These results contribute to sustainable development and resource efficiency in the hotel industry by identifying key issues in effective eco-certification implementation: choosing credible eco-certifications and maintaining high transparency. ■

²⁸ Delmas and Grant, *op.cit.*

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