

The impact of sustainability certifications on performance and competitive action in hotels

Simone Bianco ^{*,1}, Shaniel Bernard ², Manisha Singal ³

Howard Feiertag Department of Hospitality and Tourism Management, Pamplin College of Business, Virginia Tech, Blacksburg, VA, USA

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ABSTRACT

Despite the growing research interest in the benefits of sustainability certificates to businesses, their impact on hotel firms' financial performance at the competitive set (compset) level is not known. To fill this gap in the literature, this study uses data from 251 certified hotels located in Florida, United States, to analyze the effect of sustainability certificates on key performance indicators (KPIs) in hotels (e.g., Occupancy, ADR, RevPAR), compared to their compset. The findings show that certified hotels can increase their KPIs compared to competitors through a first-mover advantage. The study offers significant contributions to the literature on environmental management and competitive dynamics in the hospitality industry. We provide guidelines to managers regarding timing of response to other hotels in their competitive set when obtaining sustainability certification.

1. Introduction

Environmental, social, and governance (ESG) issues are at the forefront of hospitality corporations' agendas (Ionescu et al., 2019) due to increased pressure from stakeholders regarding the adverse societal and environmental impacts of corporate actions (Robertson and Barling, 2017). To add to these issues, the COVID pandemic has been particularly detrimental, especially to small enterprises (Sobaih et al., 2021). Hospitality firms focus on growth in tourism development, yet their operating processes cause environmental degradation and greenhouse gas emissions (Lenzen et al., 2018; Reid et al., 2017). Many consumers now demand that hospitality businesses develop a higher level of "green consciousness" (Yi et al., 2018). The hotel sector is responsible for up to 21% of the carbon footprint generated in tourism through water and energy consumption, waste generation, and carbon dioxide discharge (dos Santos et al., 2020; Pan et al., 2018). It is imperative that hotels apply more sustainable solutions to reduce pollution, increase customer satisfaction, and avoid reputational challenges (Wong et al., 2021).

In response to these challenges, hotels have implemented various green practices (e.g., towel/ linen reuse, waste recycling, obtaining sustainability certificates) and/or rebranded their properties as "eco-

friendly" or "green" hotels (Melissen et al., 2016). One option is to obtain sustainability certificates from credible, independent agencies including The World Travel and Tourism Council (WTTC), the Global Sustainable Tourism Council (GSTC), and the Florida Green Lodging Program. This measure is regarded by hotels as the most effective environmental strategy because it simultaneously reduces negative environmental impacts and provides a green image (Cavero-Rubio and Amorós-Martínez, 2020). Despite growing research on the benefits of sustainability certificates (Wong, 2022), there is insufficient research to gauge whether they offer a significant competitive advantage (Sharma et al., 2020).

Sustainability certificates have proven successful for some hotels promoting themselves as green destinations (Peiró-Signes et al., 2014) and have been received positively by salient stakeholders such as investors (Bernard and Nicolau, 2022). Despite the importance of sustainability certifications for signaling and legitimacy purposes (Geerts, 2014; Parguel et al., 2011), they are often costly (Stefan and Paul, 2008) for hotels. Consequently, the current literature has investigated the potential of sustainability certificates to secure higher return on assets/return on equity (Segarra-Oña et al., 2012), online ratings (Aznar et al., 2016; Peiró-Signes et al., 2014), stock market returns (Bernard

* Correspondence to: Wallace Hall 342, 295 West Campus Drive, Blacksburg, VA 24061, USA.

E-mail addresses: simobia@vt.edu (S. Bianco), shanielb@vt.edu (S. Bernard), msingal@vt.edu (M. Singal).

¹ <https://orcid.org/0000-0002-8300-9566>.

² <https://orcid.org/0000-0003-0849-1169>.

³ <https://orcid.org/0000-0002-3459-3049>.

and Nicolau, 2022), and internal cost savings (Geerts, 2014). Nevertheless, the extant research does not sufficiently investigate the effects of green certifications at the competitive set level.

Competitive sets (compsets) are self-selected groups of direct competitors in a local area employing criteria such as class, amenities, and location (Hesford et al., 2020). Compset analysis can be employed to examine whether hotel firms can leverage sustainability certificates to achieve a competitive advantage in their compset. Since most competition for hotels is at the local level, performance is generally measured within a geographical cluster in the compset (Hesford et al., 2020). There is a lack of literature on how competitors should react when a hotel in their compset is awarded a sustainability certificate. Since hotels attain certificates in large part to achieve a direct, immediate competitive advantage, further research is critical. Our study addresses these gaps by applying a random effect model to a data panel of 251 hotels with sustainability certification from the Florida Green Lodging Program over ten years. We employed the resource-based view and the action-reaction framework of competitive dynamics, which has not been extensively used in hospitality literature. Our research questions are a) *How do sustainability certificates affect hotels' performance compared to their compset?*; and b) *How should hotels respond if another hotel in their compset acquires a sustainability certificate?*

Our study also responds to a call for research linking sustainability initiatives to organizational performance (Rhou and Singal, 2020). We investigated whether sustainability certificates give hotels competitive advantage within their compsets; ours is the first study to apply the action-reaction framework in hospitality literature, going beyond response based solely on modifying prices. Using the resource-based view, we showed that firms can achieve at least temporary competitive advantage on imitable resources through timing and leveraging customer preferences, thus satisfying a more significant market segment. Finally, this study offers important practical implications on the proximal effect of sustainability certificates on higher performance metrics and methods for responding when a compset hotel is awarded a sustainability certificate.

Our statistical analyses show that hotels awarded sustainability certificates can achieve a competitive advantage, particularly if they are the first in their compset. Theoretically, our study confirms the first-mover advantage cited by strategy researchers. We also confirm an early-mover advantage for competitors that are rapid second or third movers; early adopters benefit more once certification is commonly adopted by others, after which this performance metrics advantage is diluted.

2. Literature review

2.1. Sustainability initiatives and hotel certification

A sustainability initiative is “an approach that aims at the long-term success of an initiative strategy by focusing on the ethical, social, environmental, cultural, and economic dimensions” (Ozdemir and Ergun, 2022). Although approximately 85% of U.S. hoteliers implement various sustainable initiatives (TripAdvisor, 2013), these are based almost entirely on the environmental dimension (Fraj et al., 2015; Geerts, 2014; Khairat and Maher, 2012; Prud'homme and Raymond, 2013). Energy saving and linen/towel reuse reminders are among hotels' most popular programs (Chen, 2019; Fraj et al., 2015), yet consumers often view these initiatives as self-serving (e.g., to increase sales/profits or profile the brand) (Rahman et al., 2015), increasing skepticism and greenwashing perceptions and lowering revisit intention (Chen et al., 2019). Today's consumers expect hotels to implement long-term sustainable initiatives and engage in public service (e.g., raise awareness of a specific cause, aid with community development, and go beyond profit) (Vlachos et al., 2009). A departure from these initiatives is viewed negatively (Forehand and Grier, 2003).

More hotels are acquiring third-party sustainability certificates, a

“voluntary procedure that sets, assesses, monitors, and gives written assurance that a business, product, process, service, or management system conforms to a specific requirement” (Black and Crabtree, 2007, p. 20). A certified hotel pays a membership fee in return for an identifiable logo (ecolabel) based on the level of environmental commitment (e.g., bronze, silver, gold, platinum) (Black and Crabtree, 2007). These certificates improve hotels' environmental management strategies and social legitimacy and attract environmentally conscious customers (Borella and de Carvalho Borella, 2016; Geerts, 2014).

Beyond these intangible benefits, the tangible effects of sustainability certificates on hotel financial performance are scant and varied (Rhou and Singal, 2020; Sharma et al., 2020). Claver-Cortés et al. (2007) concluded that the degree of advanced environmental commitment (i.e., proactive, intermediate, and reactive) in hotels did not affect financial or operational performance evaluated via occupancy rate, gross operative profit (GOP), and gross operating profit per available room (GOPPAR) per day. Other studies found that booking revenue (Chong and Verma, 2013), average daily rate (ADR), and revenue per available room (RevPAR) (Robinson et al., 2016) were unaffected for certified hotels. However, other studies have shown a positive link between sustainability certificates and hotel financial variables such as occupancy, GOP, GOPPAR (Claver-Cortés et al., 2010), net sales, return on assets (ROA), and return on equity (ROE) (Segarra-Oña et al., 2012), even during a financial crisis (Cavero-Rubio and Amorós-Martínez, 2020). A recent study with a sample of major U.S. publicly traded hotels found a positive link between sustainability certificates and hotel market value (Bernard and Nicolau, 2022).

Of the studies reviewed, only two examined the effects of sustainability certificates on competitive advantage (Peiró-Signes et al., 2014; Segarra-Oña et al., 2012). Both studies discussed the impact of ISO14001 certification with a sample of three- to five-star Spanish hotels and showed that guests rated hotels with sustainability certificates higher due to the distinctiveness of the asset (Peiró-Signes et al., 2014; Segarra-Oña et al., 2012). This is initial evidence that hotels with international certifications such as ISO 14001 may have an advantage; however, it sampled only Spanish hotels and only considered a consumer perspective. We are unaware of a study that has applied the competitive dynamics action-reaction framework to assess the competitive advantage of U.S. hotels that acquire state-level sustainability certificates within their compsets and examine the effects on key hotel performance indicators (e.g., occupancy, ADR, RevPAR). We demonstrated these relationships through the framework of the resource-based view.

2.2. Resource-based view

The resource-based view reveals how the possession of superior resources can give firms a sustained competitive advantage, mainly when the resources are valuable, rare, non-imitable, and non-substitutable (Barney, 1991). In hospitality and tourism research, the resource-based view has been used extensively as a primary theory in strategic management to investigate international hotel expansion (Kruesi et al., 2017), hotel firm product diversification (Andreu et al., 2010), diversity practices (Manoharan et al., 2021), and pricing policies (Van Der Rest et al., 2018). González-Rodríguez, Jiménez-Caballero, Martín-Samper, Köseoglu, and Okumus (González-Rodríguez et al., 2018) investigated success determinants among Spanish hotels, finding that performance is affected more by internal resources rather than external factors. This can be attributed to the industry's unique characteristics. Therefore, sector-specific features of the hotel industry should be included in analysis, especially when applying an established theory such as the resource-based view. For example, the most critical resource for a hotel is location (Fang et al., 2019), yet this resource can be imitated by a competitor that opens a hotel property at the same area in its compset. Hence, resource rarity and non-imitability (or substitutability) are uncommon in the hotel industry. Acquiring a sustainability

certificate does not prevent a competitor from doing the same, particularly when there is not a finite quantity of certificates, making the certificates imitable, substitutable, and non-rare.

When barriers to imitation are very low or nonexistent, firms can achieve superior performance by exploiting valuable resources (Bowman and Ambrosini, 2007). We hypothesize that a sustainability certificate represents a valuable resource for hotels. First, resources are valuable if they allow firms to charge premium prices and/or lower their costs relative to competitors (Barney, 1991; Bowman and Ambrosini, 2007). Sustainability certifications allow hotel firms to do both. Some customers are willing to pay premium prices for sustainable initiatives (Kang and Nicholls, 2021) such as water-saving (Casado-Díaz et al., 2020) and energy-saving (Susskind, 2014), especially guests with high incomes and high environmental values (Baker et al., 2014). Furthermore, certifications allow hotel firms to reduce costs in the long run and achieve advantages through cost efficiency and differentiation (Geerts, 2014; Singjai et al., 2018).

Second, sustainability certificates can also indirectly, positively impact hotel performance; for example, they can positively affect the surrounding communities (Rhou and Singal, 2020), which are among the major stakeholders and have a fundamental role in resource appropriation (Barney, 2018). This positive impact allows hotels to have premium or more efficient access to other resources, such as local products for their restaurants and hosting events for the local community, which in turn positively impact performance. Finally, obtaining a sustainability certification can be a signaling move that strategically communicates information to other parties (Rahman et al., 2020), signaling to customers about ongoing green initiatives and increasing a firm's legitimacy (Ching and Gerab, 2017).

However, we proposed that an increase in performance would be driven mainly by ADR, while occupancy could be slightly diminished, since attaining a sustainability certificate can save hotels money in the long run, but can be costly short term. Moreover, certified hotels are likely to increase prices knowing that customers are willing to pay more for hotels that adopt sustainable initiatives (Casado-Díaz et al., 2020; Susskind, 2014). We believed that this price increase could diminish demand from price-sensitive customers, as corroborated by previous studies showing insignificant effects of sustainability certificates on occupancy (Claver-Cortés et al., 2007; Chong and Verma, 2013; Claver-Cortés et al., 2007; Robinson et al., 2016). Hence:

H1a. : Obtaining a sustainability certificate will positively affect hotels' RevPAR compared to competitors.

H1b. : Obtaining a sustainability certificate will positively affect hotels' ADR compared to competitors.

H1c. : Obtaining a sustainability certificate will negatively affect hotels' occupancy compared to competitors.

2.3. Competitive actions and reactions

The literature on competitive dynamics investigates competitive actions and reactions of firms under a dyadic view of a firm against one or more competitors (Smith et al., 2001). Competitive dynamics literature involves two main branches: antecedents of competition and specifics of competitive actions and reactions. Antecedents of competition involve conceptual frameworks in which companies take competitive action or react to competitive action by a competitor (Chen (1996) and Chen et al. (2021) created a popular framework stating that firms can respond when they are aware of competitive action taken by a competitor, are motivated to respond, and are capable of doing so. Researchers have focused explicitly on response timing (Lee et al., 2000; Luoma et al., 2017), different types of responses (Aboulnasr et al., 2008; He et al., 2017), and various factors affecting responses (Chen and MacMillan, 1992; Yu and Cannella, 2007).

Few studies have investigated competitive dynamics among

hospitality firms. Bianco et al. (2022) used the awareness–motivation–capability framework of competitive dynamics to investigate competitive pressures posed by investors on incumbent hotel firms such as Airbnb. Moreover, Bianco et al. (2022) investigated how market commonality and resource similarity (Chen, 1996) affect the risk assessment of the stock market toward new startups entering the industry. The only study to our knowledge that examined firms' competitive actions and reactions is by Kim et al. (2018), who focused on strategic responses to price changes, finding that hotel size, age and chain affiliation affected competitive responses. In our study, a sustainability certificate is deemed a competitive action because it's initiated to gain competitive advantage (Chen and MacMillan, 1992; Guo et al., 2020). Moreover, hotels seek certification not only for environmental concerns but to increase performance by attracting customers with high environmental values who will select them over competitors (Peiró-Signes et al., 2014). Being the first hotel in a compset to take strategic action can be beneficial both because of resource acquisition and signaling, and the resulting first-mover advantage.

First-mover advantage occurs when a firm is the first to develop a new product or service in its market (Lee and Jang, 2017; Michael, 2003), and can be achieved by employing superior technologies, preempting scarce resources, and altering buyers' behavior. With sustainability certificates, firms may not use superior technologies, nor are there a fixed number of certificates that make it a scarce resource as it is for franchised restaurant locations (Michael, 2003) or hotels (Lee and Jang, 2017) which have a variety of sustainability certification schemes (Font et al., 2001). Therefore, we posit that first-mover advantage can be achieved through alterations in buyer behavior; specifically, by creating switching costs for customers. After the first hotel in a compset is awarded a certificate, customers sensitive to green initiatives may choose it over competitors. If another hotel in the compset subsequently attains a certificate, switching costs (such as loyalty programs) may discourage pro-environment customers from choosing a competitor (Qiu et al., 2015; Barber and Deale, 2014).

Switching costs are challenging for first movers to create when demand is fragmented by different opinions on product features (Capone et al., 2013). This becomes evident in the hotel industry, where customers are highly fragmented (Tanford et al., 2012) and the perception of service received varies greatly (Beldona et al., 2020). Moreover, the first hotel in a compset to be awarded a certificate will likely consider itself differentiated enough to increase its prices. Hence, we proposed that attaining a certificate as a first mover in a compset would decrease occupancy, but that the increase in ADR would result in higher RevPAR. Hence:

H2a. : Being the first hotel in a compset to obtain a sustainability certificate will positively influence RevPAR compared to competitors.

H2b. : Being the first hotel in a compset to obtain a sustainability certificate will positively influence ADR compared to competitors.

H2c. : Being the first hotel in a compset to obtain a sustainability certificate will negatively influence occupancy compared to competitors.

If a hotel decides to respond to a competitor being awarded a sustainability certificate, it will need to know the timing and order effect of the response compared to its compset. Previous literature on competitive dynamics found that the timing and order of a response influence firm performance (Chen and Miller, 2012; Gürkaynak et al., 2018). If a firm rapidly reacts to a first mover's action, it may be able to obtain an advantage share and benefits similar to the first mover (Lee et al., 2000; Luoma et al., 2017). Furthermore, reacting quickly can prevent the first mover from building imitation barriers like switching costs (Alnahedh and Pleshko, 2020; Michael, 2003), since a first-mover advantage is not always gained immediately after a competitive move (Alnahedh and Pleshko, 2020; Michael, 2003). Hence, another firm's reaction can minimize or nullify first-mover advantage.

However, firms could benefit from being late movers, particularly in

a technologically uncertain market where they can take advantage of the pioneering costs sustained by the first mover to create the market (Lee and Jang, 2017). We proposed this was unlikely in our study because the hotel market is responsive to sustainability certification (Bernard and Nicolau, 2022) and first movers do not sustain pioneering costs that competitors could appropriate.

Hence:

H3a. The longer respondents take to respond to a competitive move, the higher the negative impact will be on their RevPAR compared to competitors.

H3b. The longer respondents take to respond to a competitive move, the higher the negative impact will be on their ADR compared to competitors.

H3c. The longer respondents take to respond to a competitive move, the higher the negative impact will be on their occupancy compared to competitors.

H4a. Second movers will report higher RevPAR than late movers.

H4b. Second movers will report higher ADR than late movers.

H4c. Second movers will report higher occupancy than late movers.

Fig. 1 below schematically illustrates our hypotheses.

3. Methodology

To test our hypotheses, we applied various random effect models to determine whether obtaining a certification improved hotel performance, whether hotels should react to a compset hotel receiving a certificate, and whether response order and timing of the response mattered.

3.1. Data

Our sample consisted of an unbalanced panel dataset of 51,625 monthly observations of 251 certified hotels located in Florida, United States. We chose Florida hotels based on prior validation by several studies that it is a tourist destination and includes hotels of all levels (Rivera et al., 2021; Torres et al., 2014). Florida is also one of few states with a state-conducted green lodging program, the Florida Green Lodging Program. This program was initiated by the Florida Department of Environmental Protection and certifies hotels that commit to reducing their environmental impact in terms of water and electricity usage, waste reduction, and indoor air quality (Florida Department of Environmental Protection, 2022). It also requires hotels to proactively raise environmental awareness among employees, customers, and the general public. Participating hotels must undergo a thorough property

assessment to receive a score that awards one of four “Palm Levels,” with tier one the lowest and tier four the highest. We based our research on this certification because, in contrast to LEED certification, it does not require essential changes to hotel structure but instead considers a single hotel’s intentions and/or operational changes to achieve certification. Furthermore, it is controlled by the state of Florida, lending legitimacy, and is specifically designed for hotels, unlike the more general energy management ISO50001.

We gathered our data on all certified hotels as of August 2021 from the Florida Department of Environmental Protection website. Next, we obtained performance data from STR, a leader in hotel analytics. STR utilized the certified hotels and their award dates and provided anonymized performance data about the hotels and their respective compsets, and calculated the times between certification dates for hotels in the same compset. This enabled us to compare performance data for hotels and their compsets and determine the reaction time of competitive reactions without knowing the identity of individual hotels.

3.2. Model specification

The random effect model is a panel data model that treats unobserved heterogeneity α_i as a random number from a pre-specified distribution. We used a random effects model for each specification instead of a fixed-effect model or pooled regression model after conducting the Hausman test and controlling for variance across entities. We also conducted diagnostic checks for panel databases by testing the sample for cross-sectional dependence, heteroscedasticity, and serial correlation (see Appendix 1). Our data had cross-sectional dependence, heteroscedasticity, and serial correlation. We controlled for cross-sectional dependence using the Feasible Generalized Least Square (FGLS) technique to estimate the model. We also accounted for serial correlation and heteroscedasticity by grouping standard errors using a robust covariance matrix. Hence, our general model was specified as follows, where Y_{it} is the response variable, β_0 is the intercept, $X_{it}\beta$ represents all our predictor variables and control, and ν_{it} is the composite error:

$$Y_{it} = \beta_0 + X_{it}\beta + \nu_{it}$$

The composite error merges firm-level unobserved heterogeneity that changes across firms, but it is fixed over time (α_i) with unobserved factors that affect the response and vary across both firms and time (ϵ_{it}). Finally, to control for heterogeneity caused by time and individual firms, we adopted a series of time-fixed effects (months and year) and individual fixed effects.

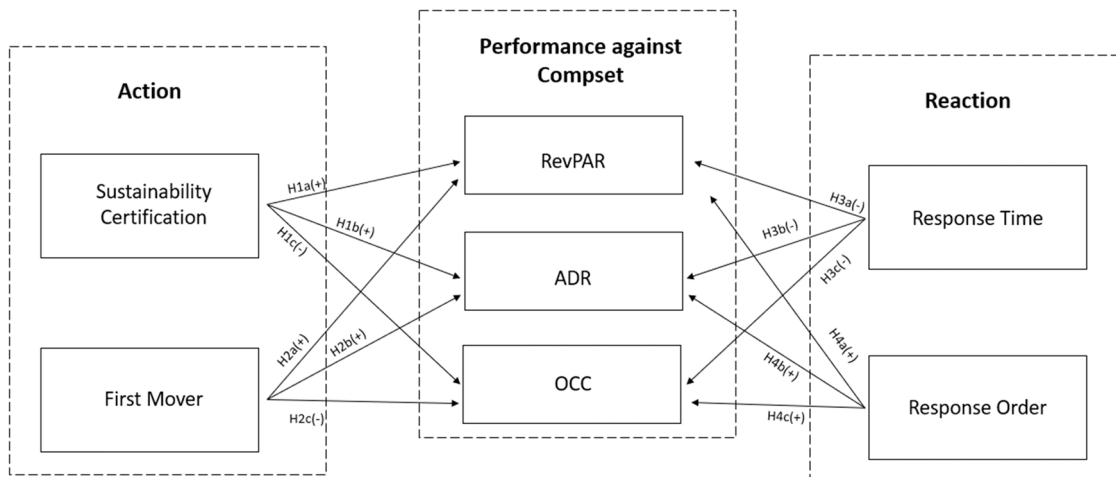


Fig. 1. Conceptual framework.

3.3. Variables

All models examined the effect of different predictor variables on the main performance measures for hotels: ADR (Espino-Rodríguez and Padrón-Robaina, 2005), OCC, and RevPAR. Hence, every model estimated the difference between the monthly performance of the focal hotels and the average of their compsets to ascertain certified hotels' performance compared to their main competitors. The use of monthly data allowed for a granular model to control for time heterogeneities (e. g. seasonality) and a different time frame in which sustainability certificates begin to affect the performance of different hotels.

The main predictor variables were *Certified*, *ActPosition*, and *ReactionTime*. *Certified* is a dummy variable that assumes the value of 1 for all months in which single hotels were certified and 0 in months in which hotels were not certified. *FirstMover* is a dummy variable that assumes the value of 1 for each month in which hotels were certified if they were first movers. *ActPosition* is a four-level categorical variable that states whether each hotel was the first, second, third, fourth, or later to receive its compset certification. We introduced both *FirstMover* and *ActPosition*, using the former variable to assess first-mover advantage and the latter to investigate the effect of the order of reaction on performance. Finally, we used *ReactionTime* because it is a count variable that states how much time passes between a first hotel in the compset becoming certified and the focal hotel reacting.

To control for additional heterogeneity, we created a series of control variables that accounted for individual, internal firm, and compset factors. The variable *Scale* controls the class of the hotel according to STR classification and is a seven-level categorical variable that classifies *Luxury* to *Independent* hotels. We controlled for hotel *Size* (the number of rooms divided into five categories), the type of *Operation* (managed/ owned or franchised), and the *Palm Level* certification level (1–4). Cluster-level controls involved the location of the compset (i.e., *Airport*, *Urban*, *Suburban*, etc.) and number of certified hotels in the compset. Table 1 describes our sample, while Appendix 2 offers in-depth description of variables.

4. Results

Table 2 shows the hypotheses results at a glance, while Tables 3–5 show the regressions results. Table 2 shows the effect of sustainability certificates on the three metrics used to assess performance. The results show that hotels with sustainability certification increased their performance compared to their compset for RevPAR, ADR, and occupancy. Hence, Hypotheses 1a and 1b were supported, while 1c was not. Table 3 shows that first-mover hotels achieved better performance than their compset hotels on all metrics. Hence, Hypotheses 2a and 2b were supported while Hypothesis 2c was not. Table 4 shows the effect of competitors' reactions on their performance, revealing that reaction time had a negative and significant impact on performance for all metrics, supporting Hypotheses 3a, 3b, and 3c. However, the effect size of the reaction time was minimal for the RevPAR metric. The results also revealed that the second hotel to receive certification performed better than late movers, supporting Hypotheses 4a, 4b, and 4c and showing that that response order matters. Late movers lost on average more than \$20,436 on monthly RevPAR. We also analyzed whether certifications affected firms' relative performance and obtained positive results.

Finally, the results showed that certifications can create competitive advantage, mostly for small-size luxury and upper-upscale hotels in urban, resort, and airport locations. Specifically, hotels with 0–75 rooms were most positively affected by a sustainability certification in terms of RevPAR. In contrast, large hotels with 300–500 rooms had the lowest gains from certification. The number of certified hotels in the compset had a negative effect on firms' performance, while the level of certification had an inverse curvilinear relationship with performance attainment. That is, an entry-level sustainability certificate (Palm Level 1) was the worst performer among all Palm Levels, while peak

Table 1
Sample description.

Characteristics	Total Certified Hotels (251)	
	Count	Percentage
Palm Level		
PalmLv1	16,632	32.22%
PalmLv2	23,976	46.44%
PalmLv3	10,584	20.50%
PalmLv4	432	0.84%
Scale		
Luxury	3456	6.69%
Upper Upscale	14,040	27.20%
Upscale	10,800	20.92%
Upper Midscale	11,232	21.76%
Midscale	2376	4.60%
Economy	648	1.26%
Independent	9072	17.57%
Location		
Urban	4536	8.79%
Suburban	14,688	28.45%
Airport	3888	7.53%
Interstate	432	0.84%
Resort	25,488	49.37%
Small Town	2592	5.02%
Size		
0–75 Rooms	2592	5.02%
75–149 Rooms	14,904	28.87%
150–299 Rooms	17,064	33.05%
300–500 Rooms	7992	15.48%
> 500 Rooms	9072	17.57%
Operation		
Managed/Owned	12,096	23.43%
Franchised	30,456	59.00%
Independent	9072	17.57%
Order Movers		
First Mover	27,648	56.64%
Second Mover	12,312	25.22%
Third Mover	5832	19.92%
Fourth+ Mover	3024	24.30%

Table 2
Result of hypotheses testing.

Hypothesis Number	Hypothesis	Result
1a	Obtaining a sustainability certificate will positively affect hotels' RevPAR compared to competitors.	Supported
1b	Obtaining a sustainability certificate will positively affect hotels' ADR compared to competitors.	Supported
1c	Obtaining a sustainability certificate will negatively affect hotels' occupancy compared to competitors.	Not Supported
2a	Being the first hotel in a compset to obtain a sustainability certificate will positively influence RevPAR compared to competitors.	Supported
2b	Being the first hotel in a compset to obtain a sustainability certificate will positively influence ADR compared to competitors.	Supported
2c	Being the first hotel in a compset to obtain a sustainability certificate will negatively influence Occupancy compared to competitors.	Not Supported
3a	The longer respondents take to respond to a competitive move, the higher the negative impact will be on their RevPAR compared to competitors.	Supported
3b	The longer respondents take to respond to a competitive move, the higher the negative impact will be on their ADR compared to competitors.	Supported
3c	The longer respondents take to respond to a competitive move, the higher the negative impact will be on their Occupancy compared to competitors.	Supported
4a	Second movers will report higher RevPAR than late movers.	Supported
4b	Second movers will report higher ADR than late movers.	Supported
4c	Second movers will report higher Occupancy than late movers.	Supported

Table 3
Effect of certification on hotels' performance.

Variables	RevPAR		ADR		Occupancy	
	Estimates	Std. Error	Estimates	Std. Error	Estimates	Std. Error
Certified	31.597 ***	0.799	37.840 ***	1.036	20.984 ***	0.455
Compset Cert Scale	-1.725 ***	0.150	-3.661 ***	0.195	-2.084 ***	0.085
Upper Upscale	-24.200 ***	1.005	-34.340 ***	1.303	-1.295 *	0.573
Upscale	-30.375 ***	1.126	-41.393 ***	1.461	-4.314 ***	0.642
Upper Midscale	-30.443 ***	1.184	-39.752 ***	1.535	-5.357 ***	0.675
Midscale	-34.509 ***	1.595	-45.859 ***	2.068	-2.535 **	0.910
Economy	-28.328 ***	2.340	-42.637 ***	3.034	12.015 ***	1.335
Independent	-39.393 ***	1.095	-45.471 ***	1.419	-6.216 ***	0.624
Location						
Suburban	-0.116	0.930	-6.376 ***	1.206	-5.140 ***	0.530
Airport	3.882 **	1.162	-2.547 *	1.506	-3.000 ***	0.663
Interstate	-4.866 *	2.678	-15.707 ***	3.472	-23.602 ***	1.527
Resort	2.387 **	0.857	-1.645	1.111	-1.575 **	0.489
Small Town	1.938	1.333	-4.787 *	1.729	-2.572 ***	0.760
Size						
75–149 Rooms	-9.879 ***	1.149	-18.803 ***	1.490	-0.276	0.655
150–299 Rooms	-9.817 ***	1.210	-16.277 ***	1.569	-0.308	0.690
300–500 Rooms	-27.045 ***	1.323	-35.413 ***	1.715	-6.390 ***	0.754
> 500 Rooms	-21.513 ***	1.387	-33.824 ***	1.799	-0.158	0.791
Operation						
Managed	-3.92990 ***	0.74710	-4.466 ***	0.96865	2.600 ***	0.426
Palm Level						
Palmvl2	6.58547 ***	0.57028	7.942 ***	0.739	0.759 *	0.325
Palmvl3	18.85328 ***	0.71692	25.633 ***	0.929	5.478 ***	0.409
Palmvl4	5.41986 *	2.51852	5.015	3.265	5.456 ***	1.436

* = p-value < 0.1 ** = p-value < 0.05 *** = p-value < 0.01.

Table 4
Effect of first-mover advantage on hotels' performance.

Variables	RevPAR		ADR		Occupancy	
	Estimates	Std. Error	Estimates	Std. Error	Estimates	Std. Error
First Mover	6.554 ***	0.589	7.989 ***	0.762	6.964 ***	0.336
Compset Cert Scale	-1.338 ***	0.154	-3.192 ***	0.200	-1.714 ***	0.088
Upper Upscale	-24.391 ***	1.019	-34.568 ***	1.318	-1.420 *	0.582
Upscale	-30.794 ***	1.143	-41.906 ***	1.479	-4.794 ***	0.653
Upper Midscale	-32.705 ***	1.199	-42.462 ***	1.552	-6.875 ***	0.685
Midscale	-33.744 ***	1.618	-44.956 ***	2.093	-2.298 *	0.925
Economy	-30.511 ***	2.375	-45.277 ***	3.073	10.101 ***	1.358
Independent	-40.223 ***	1.110	-46.456 ***	1.436	-6.605 ***	0.635
Location						
Suburban	1.233	0.947	-4.784 ***	1.225	-4.709 ***	0.541
Airport	3.914 ***	1.183	-2.536 *	1.531	-3.496 ***	0.676
Interstate	-9.161 ***	2.715	-20.870 ***	3.513	-26.816 ***	1.552
Resort	3.050 ***	0.869	-0.862	1.125	-1.329 **	0.497
Small Town	3.071 *	1.357	-3.463 *	1.756	-2.443 **	0.776
Size						
75–149 Rooms	-8.818 ***	1.165	-17.542 ***	1.508	0.232	0.666
150–299 Rooms	-6.626 ***	1.225	-12.479 ***	1.586	1.380 *	0.701
300–500 Rooms	-23.717 ***	1.341	-31.455 ***	1.736	-4.711 ***	0.767
> 500 Rooms	-16.585 ***	1.401	-27.921 ***	1.813	3.134 ***	0.801
Operation						
Managed	-4.735 ***	0.757	-5.425 ***	0.980	2.185 ***	0.433
Palm Level						
Palmvl2	6.128 ***	0.578	7.397 ***	0.747	0.478	0.330
Palmvl3	18.578 ***	0.727	25.299 ***	0.940	5.210 ***	0.415
Palmvl4	4.486 *	2.553	3.903	3.303	4.945 ***	1.460

* = p-value < 0.1 ** = p-value < 0.05 *** = p-value < 0.01.

performance was achieved by hotels with a Palm Level 3 certificate as opposed to levels 2 and 4.

5. Discussion

Our analyses showed that, overall, a sustainability certificate helped hotels increase performance compared to direct competitors in their compset. Based on previous literature on sustainability certificates

(Claver-Cortés et al., 2007) and considerations about price increases, we hypothesized that an increase in RevPAR for certified hotels would be dictated by the rise in ADR with a decrease in occupancy. However, we found that certified hotels improved their performance on all metrics. This result could be explained by additional dimensions of the resource-based view—unmet needs and market size—which allow for an ex-ante identification of resources that give firms competitive advantage (Hinterhuber, 2013). In addition to being valuable by

Table 5
Effect of competitors' reaction order and time on performance.

Variables	RevPAR		ADR		Occupancy	
	Estimates	Std. Error	Estimates	Std. Error	Estimates	Std. Error
Response Order						
Second	-10.594 ***	0.623	-12.187 ***	0.809	-1.236 **	4.067
Third	-14.036 ***	0.869	-17.378 ***	1.128	-3.524 ***	5.545
Fourth and Later	-20.436 ***	1.277	-24.356 ***	1.658	-6.368 ***	8.522
Reaction Time	-0.0149 ***	0.000	-2.020 ***	3.884	-7.574 ***	2.185
Compset Cert Scale	1.759 ***	0.211	0.152	0.274	3.180 **	1.209
Upper Upscale	-26.975 ***	1.053	-37.755 ***	1.367	-3.398 ***	5.915
Upscale	-34.156 ***	1.183	-46.340 ***	1.536	-6.428 ***	6.648
Upper Midscale	-35.698 ***	1.255	-46.475 ***	1.629	-7.210 ***	7.058
Midscale	-35.080 ***	1.651	-47.258 ***	2.144	-3.456 ***	9.268
Economy	-34.515 ***	2.426	-50.590 ***	3.150	7.049 ***	1.362
Independent	-44.145 ***	1.153	-49.247 ***	1.496	-1.102 ***	6.473
Location						
Suburban	0.479	0.979	-6.199 **	1.271	-6.946 **	5.513
Airport	3.806 **	1.219	-3.328 *	1.583	-4.001 **	6.847
Interstate	-9.392 **	2.740	-22.310 ***	3.557	-2.781 **	1.538
Resort	1.721 *	0.897	-2.775 *	1.164	-3.008 ***	5.047
Small Town	1.967	1.379	-5.434 **	1.790	-2.521 **	7.741
Size						
75–149 Rooms	-6.410 ***	1.280	-16.144 ***	1.662	-7.064	7.225
150–299 Rooms	-5.847 **	1.380	-13.119 ***	1.792	-9.562	7.809
300–500 Rooms	-22.775 ***	1.499	-31.238 ***	1.946	-6.371 ***	8.438
> 500 Rooms	-15.870 ***	1.596	-28.194 ***	2.072	-1.098	9.079
Operation						
Managed	-1.896 *	0.790	-1.558	1.026	3.513 ***	4.437
Palm Level						
Palmvl2	8.443 ***	0.616	10.546 ***	0.800	1.153 ***	3.462
Palmvl3	19.262 ***	0.763	26.464 ***	0.991	5.516 ***	4.288
Palmvl4	12.292 ***	2.625	14.097 ***	3.408	9.548 ***	1.473

* = p-value < 0.1 ** = p-value < 0.05 *** = p-value < 0.01.

allowing hotels to increase their prices (Bowman and Ambrosini, 2007), resources need to satisfy unmet needs for a market segment large enough to cover firms' fixed costs (Hinterhuber, 2013). We may have underestimated the size of the market segment sensitive to sustainability certificates. We hypothesized that a price increase would transfer some demand to cheaper, non-sustainable alternatives. However, the results show that sustainability certificates, as a value-added resource, can confer competitive advantage by balancing the attributes of being rare, non-imitable, and non-substitutable to link to unmet needs that are able to satisfy a market segment that is large enough to cover firms' fixed costs of obtaining the certificate.

We also believe that certificates' signaling and reputational effects provide customers sufficient incentives to remain loyal to the focal hotel. In terms of action, first-mover hotels to obtain sustainability certificates could achieve higher revenues by setting higher prices. This advantage is attributed to consumer switching costs barriers (Michael, 2003), when consumers perceive that "it's just not worth it" since they can still enjoy their existing loyalty customer discounts without the switching burdens of emotional cost and cognitive effort (Formell, 1992). Furthermore, contrary to our hypothesis, first movers attained higher occupancy. This could be credited to the general ability of sustainability certificates to satisfy a more extensive market segment (Hinterhuber, 2013). Moreover, despite the general fragmentation of demand for hotels (Tanford et al., 2012), these results show that demand reacts homogeneously to the attainment of a sustainability certificate, giving first movers more opportunities to create switching costs barriers (Capone et al., 2013).

Switching costs barriers can be partially offset by competitors reacting quickly to a competitive move made by a first mover (Lee et al., 2000). However, despite being negative as predicted, we found that the effect size of reaction time was not very large for RevPAR. This shows that reaction time is not fundamental in offsetting the creation of switching costs barriers by first movers, as indicated by the general literature (Gürkaynak et al., 2018; Lee et al., 2000). This can be attributed to sector-specific characteristics of the hotel industry. Hotels create

switching cost barriers by increasing customer loyalty and knowledge (Koo et al., 2020), knowing that allegiance cannot be built quickly.

Moreover, loyalty cannot create switching cost barriers for every guest in the same way because loyalty is not only created at the location level but also at the brand or parent company level, which can affect perceived switching costs when a competitor becomes certified. For example, customers may choose Hotel A over Hotel B despite being a member of Hotel B's loyalty program because of Hotel A's the sustainability certification. However, if Hotel B also becomes certified, the same customer may not perceive switching cost barriers and may choose Hotel B over Hotel A. This decision can be taken regardless of Hotel B's reaction time due to loyalty, the leading creator of switching costs barriers (Koo et al., 2020).

6. Implications

Our study offers several theoretical and practical implications. First, it contributes to the environmental management literature by showing that a sustainability certificate is a value-added resource that improves hotel firm performance over direct competitors in a compset, in terms of RevPAR, ADR, and occupancy. Second, we add to the competitive dynamics hospitality literature by introducing the action–reaction framework for analyzing inter-firm competition by showing strategic actions and characteristics of reactions in compsets. Third, we add to the hospitality literature on the resource-based view by showing how the sector-specificities of the field allow firms to achieve competitive advantage by balancing the missing characteristics of rarity, non-imitability, and non-substitutability with a resource that is valuable and able to satisfy a specific market segment. Fourth, we add to the literature on first-mover advantage by showing how sustained switching costs barriers are created locally with a sustainability certificate. Fifth, we tested the effect of industry-specific sustainability certifications at the state level (e.g., Florida Green Lodging Program), thus filling research gaps linking sustainability initiatives to organizational

performance (Rhou and Singal, 2020).

Finally, the current study offers practical implications. Our study aids local-level decision makers in making informed decisions about implementing sustainability initiatives to attain certificates, whether to sustain initial costs to be a first mover in their compset in such endeavors, and how to respond if a direct competitor is awarded a sustainability certificate. Since sustainability certificates are increasingly recognized as an effective environmental strategy for hotels due to the win-win benefits they provide for all stakeholders involved (Cavero-Rubio and Amorós-Martínez, 2020), hotels with “low-cost-no-cost” sustainable initiatives such as towel/linen reuse programs should consider sustainability certificates as an additional option to potentially improve key performance indicators.

While hotels may incur initial high costs to implement policies and processes to obtain sustainability certificates, this proactive response may offer a first-mover advantage, not only reducing a hotel's operation costs over time but increasing opportunities to meet the growing demand for eco-friendly products and services (Sun et al., 2020). Consequently, sustainability certification initiatives could be integrated into hotels' central marketing efforts, instead of being a side agenda. This could empower hotel management to transition from merely displaying sustainability certificates on their websites to training employees to communicate openly to guests about a hotel's sustainability initiatives. If another hotel operating in the compset is already certified, hotels may consider moving swiftly to obtain sustainability certificates to potentially win back consumers affiliated with their loyalty programs and seeking eco-friendly accommodation services. To further enhance the distinctiveness of a sustainability certificate, hotels may consider developing unique community outreach programs and negotiating exclusive sponsorship. This approach should be included in a hotel's marketing material to showcase its differentiation and increase its competitive advantage, since unique sustainability programs positively affect hotels' surrounding communities (Rhou and Singal, 2020).

7. Limitations and future research

Despite our study's significant theoretical and practical contributions, it possesses some limitations. First, unlike previous research that used international samples and sustainability certificates (e.g., ISO

14001) to test effects on hotel financial performance, our study used a sample of hotels located in Florida, U.S.A., and a state-provided sustainability certificate. While potentially limiting the generalizability of the findings, it offers opportunity for future research examining the effects of state-level certification on tangible and intangible hotel performance metrics. Moreover, it allows for the use of industry-specific certification to compare hotels in a similar geographical area. Future research may adopt a similar methodology to test other types of state-level certificates in different states or countries.

Second, we introduced the action-reaction framework to hospitality literature by evaluating reactions in a single dimension. However, competition is multidimensional, and competitors may react by modifying prices, altering room capacities, increasing marketing expenses, and launching similar competitive attacks in other markets where multiple firms compete. Future research may investigate multidimensional responses of hotel locations to a competitor awarded a sustainability certificate. Finally, compsets differ, so a property that considers another property in their compset may not appear back in the other compset. This selection bias could be a limitation because the order of responses is based on the compset (e.g., a hotel may be third in its compset to be certified but simultaneously be first in another compset). Our analysis mimicked management choices and reflects the dyadic view of competition that is fundamental in competitive dynamics research (Chen, 1996).

8. Conclusion

Our study answers a call to improve research on the impact of sustainability initiatives on hotel performance (Rhou and Singal, 2020). We investigated the effect of sustainability certificates on hotel performance metrics directly and when compared to a hotel's compset. We also explored the timing and order effect of the response compared to its compset. We found that the attainment of a sustainability certificate resulted in higher property-level performance for hotels, especially those with first-mover advantage, by creating switching costs barriers. Moreover, we suggest that responders imitate the first mover by attaining a sustainability certificate, but that the order of the response (i.e., being the second hotel in the compset rather than the third to be awarded a certificate) is more important than the timing of reaction.

Appendix 1. Diagnostics for panel data modeling

Test for variance across entities

Lagrange Multiplier test – Breusch-Pagan for unbalanced panels

Chisq: 642126, df = 1, p-value < 0.0000

Result: We reject the null hypothesis of zero variance across entities. Random Effect is appropriate

Test for Cross-sectional dependence

Pasaran CD Test for cross-sectional dependence in panels

Z = 19.333 p-value = <0.00000

Result: We reject the null hypothesis of no cross-sectional dependence.

Test for Serial Correlation

Breusch-Godfrey/Wooldridge test for serial correlation in panel models

Chisq: 45696, df = 216, p-value < 0.0000

Result: We reject the null hypothesis of no serial correlation

Test for heteroscedasticity

Studentized Breusch-Pagan Test

BP = 4547.6, df = 21, p-value < 0.0000

Result: We reject the null hypothesis of homoscedasticity. Hence, the error term is heteroscedastic.

Appendix 2. Description of variables

Variable	Reason for inclusion	Type of Variable	Description
RevPAR	Dependent Variable	Continuous	RevPAR is the Revenue Per Available Room. Hence the total room revenue divided by the total number of rooms. In this study, it is calculated as the difference between each focal hotels' RevPAR and the average RevPAR of its competitive set.
ADR	Dependent Variable	Continuous	ADR is the Average Daily Rate and it is calculated by dividing the total room revenue by the number of room sold in the period under investigation (in our case, monthly). In this study, it is calculated as the difference between each focal hotels' ADR and the average ADR of its competitive set.
Occupancy	Dependent Variable	Continuous	Occupancy represents the percentage of occupied rooms during the period under investigation (in our case, monthly). In this study, it is calculated as the difference between each focal hotels' Occupancy and the average Occupancy of its competitive set.
Certified	Independent Variable	Dummy	Certified is a dummy variable that assumes the value of 1 every month in which a hotel is certified, 0 otherwise.
First Mover	Independent Variable	Dummy	First Mover is a dummy variable that assumes the value of 1 in the case the focal hotel was the first in its competitive set to receive a sustainability certification, 0 otherwise.
Response Order	Independent Variable	Categorical	Response Order is a 4-level categorical variable representing the order in which the focal hotel was awarded a sustainability certificate within its compset. This variable show whether the focal hotel was the first, second, third, or fourth and over to receive a sustainability certification in its competitive set.
Reaction Time	Independent Variable	Count	Reaction Time is a count variable that has a value for every hotel that was awarded a sustainability certificate and was not the first in its competitive set to do so. Specifically, this variable measures the number of days passed between the certification received by first mover and the certification received by the focal hotel.
CompsetCert	Control	Count	CompsetCert is a count variable that shows the number of hotels that received a sustainability certificate in the submarket in which the focal hotel operates.
Scale	Control	Categorical	Scale is a 7-level categorical variable that illustrates the class of the hotel. The 7 levels are: Luxury, UpperUpscale, Upscale, UpperMidscale, Midcale, Economy, and Independent. This variable is provided directly by STR.
Location	Control	Categorical	Location is a 6-level categorical variable that shows the type of location in which the hotel is in. These different locations are: Urban, Suburban, Airport, Interstate, Resort, and Small Town. This variable is provided directly by STR.
Size	Control	Categorical	Size is a 5-level categorical variable that roughly indicates the number of rooms and it is used as a control for hotel size. The 5 levels are: 0–75 Rooms, 75–149 Rooms, 150–299 Rooms, 300–500 Rooms, > 500 Rooms. This variable is provided directly by STR.
PalmLvl	Control	Order	PalmLvl is a 4-level order variable that indicates the certification level of the focal hotel, which can be from a lowest level of 1 to the highest level of 4.
Operation	Control	Categorical	Operation is a 2-level categorical variable that controls for hotels that are either Managed/Owned by the parent company or franchised to a third party. This variable is provided directly by STR.

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