A Study on the Evaluation of the Innovation Efficiency of Star Hotel Services Based on the DEA-Malmquist Index

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1. Introduction

Since the twenty-first century, the Chinese hotel industry has been developing rapidly and the sales revenue of the industry is on the rise in general, but the amount of star-rated hotels in China has dropped from the data of star-rated hotels disclosed by the Ministry of Culture and Tourism. Particularly, under the influence of COVID-19 epidemic, hotels, as a service industry, were greatly impacted by the epidemic, resulting in the hotel industry falling into a downturn during the epidemic.

According to the market survey, it is found that most hotel groups in China, in order to achieve economies of scale and increased profits, also integrate low-star hotels into their business segments when making business strategies; from the perspective of the domestic consumption environment, the current market share of economic hotels, which are nonhigh-star hotels, is a significant figure. But is it the larger scale and stronger assets of high-star hotels that lead to higher overall efficiency? Or are low-star hotels more productive because of the cost-effectiveness factor? With the continuous influence of the epidemic, this problem is particularly important for hotel operators.

Therefore, we need to reflect on this relationship by measuring the efficiency of star-rated hotels. Overseas, there are many studies discussing the efficiency of star-rated hotels, for example, Min et al. [1] measured the comparative efficiency of six luxury hotel chains in South Korea by comparing them with their simultaneous operating conditions and competitors. Also, this study provided a detailed competitive situation, revealed the weaknesses and strengths of these hotels, pointed out the challenges and opportunities in the Korean hotel industry, and provided some suggestions for management. This is a more comprehensive research process that can demonstrate the benefit of analyzing hotel efficiency and provide some suggestions for subsequent research.

An original study: Oliveira et al. [2] analyzed the different efficiency impacts of four-star and five-star hotels in Portugal. Their results showed that although hotels with higher stars tend to achieve a higher level of revenue efficiency, and the rank of stars does not completely affect the efficiency results.
There are some insights on the issue of the relationship between star rating and efficiency in the current academia: on the one hand, scholars such as Tarin [3], Arbelo-Pérez et al. [4] their argument is that the highest input does not necessarily lead to the highest output, while low-star hotels are able to achieve their competitive advantage by controlling their costs. On the other hand, Assaf and Agbola [4, 5] have another different point of view: they believe the more high-star hotels, the more efficient they will be because high-star hotels have to be more effective in order to maintain their competitive advantage and star status.

Foreign studies on hotel efficiency are more numerous and comprehensive, and the two different insights above are exactly the same questions that we have doubts about, are there also such contradictions in Chinese hotels? There are some domestic studies on the efficiency of star-rated hotels in China: for example, Zhang and Cheng [6], Liu and Dynasty [7] analyzed the efficiency of regional star-rated hotels by provincial administrative regions in China and suggested the reasons affecting the efficiency and then analyze dialed the regional differences in this. To our knowledge, most of the current research on the efficiency of star-rated hotels in China has examined regional differences, with few studies specially analyzing the relationship between star rating and efficiency of star-rated hotels in China in general.

Measuring efficiency is an indispensable and important process in our research, and in this study, we use DEA, a professional analysis software that helps us to have a clearer understanding of the efficiency of decision units from the perspective of inputs and outputs, and many previous studies have used DEA methods to measure performance. This study is to use the DEA-Malmquist model to measure the efficiency of service innovation in each of the star hotels [8].

Therefore, the next research in this paper is not only meaningful for the study of the efficiency of star-rated hotels in China but can also provide some suggestions for hotel managers to improve the efficiency of service innovation and also for investors who want to join the hotel industry. The main part of this paper is about the study of service innovation efficiency of star hotels in China, and we can solve the problem from these three aspects: 1. What factors have led to the deterioration of the efficiency of star hotels? 2. Which type of class of star hotels will be better developed in China in the epidemic? 3. What position should the Chinese government take regarding the future development of star hotels in China?

So the rest of this paper will proceed in three parts: Section 2 describes data sources and selection of indicator system; Section 3 provides introduction of methodology and model; Section 4 includes presentation of empirical results, drawing results from the data of star-rated hotels in China; and Section 5 provides reflections and summary, drawing conclusions and recommendations.

2. Data Sources and Selection of the Indicator System

To ensure the validity of the required data, first, the star-rated hotel data used in this study were obtained from the Annual National Star-rated Hotel Statistical Report published by the Ministry of Culture and Tourism, and we selected the operating data of each star-rated hotel in China from 2015 to 2021 and used each year as a DMU in the following data analysis [9].

Our system of evaluation indicators for hotel service innovation efficiency is made up of input indicators and output indicators. The selection of these two indicators is an important operation in performing the data envelopment analysis method, and we have taken full consideration in the selection of the indicators to ensure the validity and reasonableness of the analysis results [10].

Generally speaking, the size of a hotel can be measured by fixed assets, while taxes can also reflect the hotel’s inputs. These two factors are the important factors that affect the hotel’s operating efficiency. Naturally, we include these two factors in the input indicators of our index system. Besides, the hotel industry is a comprehensive service industry, and the wages paid to employees account for a large part of the total financial expenditure, while the size of the hotel business can also be reflected by the number of employees, so we count employees as one of the input indicators.

Wiper et al. [11]; in order to standardize their measure of the revenue efficiency of Spanish hotel chains and be able to compare different hotel chains of different sizes to ensure relevance, suggest using the number of hotels, the number of rooms, or the number of employees as indicators, standardizing on these indicators. We have therefore adopted a number of rooms, which is closely related to hotel operations, as an input indicator, in a similar way to the average room rate, reflecting the contribution of room revenue. Both of them contribute a lot to the room revenue, so we also select the number of rooms and the average room price in our input index.

In summary, these five indicators are included in our input metrics: fixed assets, taxes, number of employees, average room rate, and number of rooms.

In terms of the output indicators, theoretically, the output is a reflection of the efficiency of the hotel, and most scholars consider hotel revenue as an output indicator when studying hotel efficiency Pérez-Rodríguez and Acosta-Gonzáles [12]. The output indicator we have chosen naturally includes the hotel operating income, which is divided into hotel room income and food and beverage income, both of which have a significant impact on the assessment of hotel efficiency.

Profit is closely related to hotel operating income, which represents the difference between total revenue and sales cost. Profit can be regarded as a measure of hotel profitability, so it should be regarded as output. At the same time, measuring the hotel room performance needs to be reflected by the room occupancy rate, which reflects the extent of effective room occupancy. Room occupancy has a significant impact on hotel room revenue and also captures the revenue generated from this component of room occupancy for hotels of different sizes.

Therefore, we have selected four output indicators, namely room revenue, food and beverage revenue, profit, and room occupancy. In summary, we have selected five input indicators and four output indicators, for a total of nine indicators, which are summarised in Table 1.
The choice of input and output indicators. 

Therefore, we need to select the suitable indicators for the different effects that we want to achieve when running the data, and we can leave a latitude in the choice of input and output indicators.

### 3. Introduction of Methodology and Model

In order to analyze the dynamic changes of hotel industry efficiency more deeply, we need a model that can monitor the dynamic changes of efficiency, and the DEA-Malmquist model is of great help to us. The DEA-Malmquist model combined with Malmquist index, by adding the variable of time, makes a dynamic analysis of the efficiency change of the sample from time period to (t + 1) period and determines the main factors that affect the efficiency, so as to reflect the utilization degree of the hotel’s production factors, and finally realize the improvement of the hotel’s total factor productivity.

So, in this paper, we use data envelopment analysis, or DEA, to analyze the research. The first was Farrell [14] who provided a measure of productivity, the data envelopment analysis. In the aftermath, data envelopment analysis has been favored by many scholars. As a reliable method of analysis, there are many studies in the field of the hospitality industry. For example, studies by scholars such as Neves and Lourenc [15]; Manasakis et al. [16]; Neves and Lourenc [15]; Sanjeev [17]; and others, used data envelopment analysis to study hotel performance and obtained the desired results. These studies are good applications of data envelopment analysis in the field of the hospitality industry and prove to us that data envelopment analysis is practically feasible in hotel efficiency analysis.

Malmquist [18] created the Malmquist Total Factor Productivity Index and named this index the Malmquist Index. Scholars such as Caves [19] combined Malmquist and DEA to create the DEA-Malmquist Index method. When using the Malmquist index approach, total factor productivity (TFP) changes between two data points (e.g., two data points for a specific region in adjacent time periods) by calculating the ratio of the distance of each data point relative to the common technology. In the output-oriented DEA model, the Malmquist TFP change index between periods t and (t + 1) is

\[
{\text{tfp}} = \frac{M^{t+1}(x^{t+1}, y^{t+1}, x', y')}{M^t(x^t, y^t)}
\]

\[
\left[ \frac{D_t^f(x^{t+1}, y^{t+1})}{D_t^t(x^t, y^t)} \times \frac{D_{t+1}^f(x^{t+1}, y^{t+1})}{D_{t+1}^t(x^t, y^t)} \right]^{1/2}
\]

If TFP is greater than 1, it indicates an increase in the level of total factor productivity and vice versa; a ratio of change in one of the factors comprising the index greater than 1 indicates that it is the reason for its increased efficiency and vice versa leads to a decrease in its level of efficiency. An important breakthrough in fire, Fare et al. [20], was the use of the DEA approach to calculate the Malmquist index. Thereby decomposing the Malmquist index into changes in technical efficiency (EC) and changes in production technology (TC). The formula is as follows:

\[
\text{Effch} = \frac{D_t^f(x^{t+1}, y^{t+1})}{D_t^t(x^t, y^t)}
\]

\[
\text{Tech} = \left[ \frac{D_t^f(x^{t+1}, y^{t+1})}{D_t^t(x^{t+1}, y^{t+1})} \times \frac{D_{t+1}^f(x^t, y^t)}{D_{t+1}^t(x^{t+1}, y^{t+1})} \right]^{1/2}
\]

Technical efficiency, EC, represents the degree to which the DMU pursues the optimal production frontier from period “t” to period “t + 1”; technological change in production, TC, represents the technological progress index of the DMU from the period “t” to period “t + 1,” which represents the movement of the DMU’s technological frontier from the period “t” to period “t + 1”.

Again, the results of these two calculations are bounded by 1: if EC > 1, then technical efficiency has increased, and vice versa; if TC > 1, then technical progress has been made, and vice versa; if the result obtained is 1, then the corresponding efficiency remains unchanged, where tfp = M^{t+1}(x^{t+1}, y^{t+1}, x', y') = Effch × Tech.

If the returns to scale are variable, the index of change in technical efficiency can be further disaggregated into an index of pure technical efficiency (petch) and an index of efficiency of scale (sech), which can be expressed as effects = petch × sech.

<table>
<thead>
<tr>
<th>Type of indicator</th>
<th>Indicator name</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input indicators</td>
<td>Fixed assets</td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td></td>
<td>Number of employees</td>
<td>Million</td>
</tr>
<tr>
<td></td>
<td>Average room rate</td>
<td>RMB/Per night</td>
</tr>
<tr>
<td></td>
<td>Number of rooms</td>
<td>Million</td>
</tr>
<tr>
<td></td>
<td>Tax</td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td>Output indicators</td>
<td>Room revenue</td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td></td>
<td>Food and beverage revenue</td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td></td>
<td>Profit</td>
<td>Hundred million yuan</td>
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<tr>
<td></td>
<td>Room occupancy rate</td>
<td>%</td>
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</table>

### Table 1: Service innovation efficiency input-output indicators.

<table>
<thead>
<tr>
<th>Type of indicator</th>
<th>Indicator name</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Fixed assets</td>
<td></td>
<td>Hundred million yuan</td>
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<tr>
<td>Number of employees</td>
<td></td>
<td>Million</td>
</tr>
<tr>
<td>Average room rate</td>
<td></td>
<td>RMB/Per night</td>
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<tr>
<td>Number of rooms</td>
<td></td>
<td>Million</td>
</tr>
<tr>
<td>Tax</td>
<td></td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td>Room revenue</td>
<td></td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td>Food and beverage revenue</td>
<td></td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td>Profit</td>
<td></td>
<td>Hundred million yuan</td>
</tr>
<tr>
<td>Room occupancy rate</td>
<td></td>
<td>%</td>
</tr>
</tbody>
</table>

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service innovation, is calculated as

\[
\text{Tp} = \text{Effch} \times \text{Tech} = \text{pech} \times \text{sech} \times \text{tech}.
\]

4. Empirical Research

4.1. Overall Indices and Changes. This research article takes the period from 2015 to 2019 as the research time and selects each star-rated hotel in China as the research object, with data from the Annual National Star-rated Hotel Statistical Report released by the Ministry of Culture and Tourism of China. Among them, the factors affecting the total factor productivity (service innovation efficiency) of star-rated hotels are analyzed by comparing the service innovation efficiency, comprehensive technical efficiency.

Change, pure technical efficiency, scale efficiency, and technological progress index of each star-rated hotel, and the corresponding suggestions are given to promote better and faster development of the star-rated hotel industry in China. By constructing a DEA (Data Envelopment Analysis)-Malmquist model to study the input-output efficiency of star-rated hotels from a quantitative perspective, the service innovation efficiency of each star-rated hotel is obtained as shown in Table 2.

From Tables 2 and 3, it can be seen that the mean value of service innovation efficiency of star-rated hotels in China shows a state of rising and then falling, and the service innovation efficiency of each star-rated hotel reached the state of DEA effective in 2018, and the mean value reached the peak in 2018, and from the viewpoint of the internal efficiency influencing factors of hotels, the service innovation efficiency in 2018 all reached the state of DEA effective mainly brought by the efficiency of technological progress. In terms of the external environment, which was due to the fact that in 2018, the hotel industry entered a new round of growth cycle, the new supplies were being slowly absorbed by the market, the guest structure was further improved, and the market demand was rising. The overall level of industry performance has improved and the confidence of operators in future hotel performance enhancement has strengthened. However, along with the cyclical development of hotels, the spring of the industry in 2018 has not continued to 2019, with a cliff-like decline in the efficiency of service innovation in 2019. This is due to the impact of the international political situation and market environment in 2019, which sent the hotel market into a cold winter.

From Figure 1 and Table 3, the five-year period from 2015 to 2019 for different star hotels, represented by five-star hotels, shows an overall decreasing trend, with a 34.5% decrease in service innovation efficiency in 2019 relative to 2018. The shift from a DEA efficient state in 2018 to a DEA inefficient state in 2019 is explained by the fact that the DEA inefficient state is caused by the inefficiency of technical progress and pure technical efficiency. So high-star hotels should also improve production technology and management level on the original basis, keep improving the efficiency of the use of resources, increase the investment in technological innovation in order to improve the efficiency of service innovation, create a more stable hotel base, and establish their own unique brand in order to respond to adverse changes in the external environment. As for the low-star hotels, represented by the one-star hotels, the service innovation efficiency is on the overall upward trend, and in 2019 when the hotel industry is facing the cold winter period, although there is a decline, it is still able to maintain the DEA effective state, it is not difficult to see the strong vitality shown by the low-star hotels in the face of the adverse external circumstances.

By 2019, the number of star-rated hotels nationally had decreased to 8,920, of which 822 were five-star, 2,443 were four-star, 4,350 were three-star, 1,268 were two-star, and 37 were one-star. There was an overall downward trend in revenue (Figure 2). How did the development of China’s star-rated hotels in these five years suffer simply from the influence of size? How does the service innovation efficiency of star-rated hotels change, does scale efficiency have the greatest impact on service innovation efficiency, and how much does technological progress contribute? Malmquist can dynamically reflect the changes in service innovation efficiency of each star-rated hotel. Applying the Malmquist index to disaggregate the service innovation efficiency of star-rated hotels from 2015 to 2019, the following results can be obtained.

Table 4 presents the Malmquist index and its decomposition results data for each year of service innovation efficiency for star-rated hotels from 2015 to 2019. It can be seen that the average values of all indices for star-rated hotels in China are valid and all greater than 1 over the five-year period from 2015 to 2019, and the comprehensive technical efficiency index has been maintained at a level greater than 1 for each year. Even after the cold winter period, the future development of the hotel industry is more promising as long as hotels pay attention to the improvement of comprehensive technical efficiency and the level of technological progress, thereby enhancing the efficiency of service innovation.

Through Figure 3, it can be found that during the five years from 2015 to 2019, the changing trend of the comprehensive technical efficiency index of China’s star-
rated hotels basically remained parallel to the horizontal axis, floating around 1.1, with a small and relatively stable change range, which indicates that, during these five years, the comprehensive technical efficiency of China’s star-rated hotels did not change significantly and could be maintained in DEA effective state. On the other hand, the fluctuation of the technical progress efficiency index is more obvious and unstable, moving back and forth between the DEA effective state and the invalid state, which has a greater impact on the efficiency of service innovation. However, from an overall perspective, the change in the service innovation efficiency index was relatively stable during these five years, except for the discontinuous decline during 2018–2019 due to the cyclical development of the hospitality industry, which was preceded by a steady upward trend in service innovation efficiency from 2015 to 2018.

By comparing the composite technical efficiency with the technological progress index, it is easy to see that the relationship between them moves inversely, which is likely to be caused by the lag of technological progress on the performance of the composite technical efficiency. Comparing the trends of the Technical Progress Index and Total Factor Productivity (Service Innovation Efficiency) shows that the two trends are converging, indicating that technical progress is a key factor influencing the improvement of Service Innovation Efficiency. This shows the importance of increasing investment in technological innovation and training services and technical talents to enhance the technology content of the hotel industry.

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</thead>
<tbody>
<tr>
<td>Five-star</td>
<td>3.034</td>
<td>1.370</td>
<td>0.679</td>
<td>1.353</td>
<td>1.761</td>
<td>0.398</td>
<td>6.154</td>
<td>0.892</td>
<td>2.466</td>
<td>1.511</td>
<td>1.202</td>
<td>0.787</td>
</tr>
<tr>
<td>Four-star</td>
<td>0.993</td>
<td>1.003</td>
<td>1.064</td>
<td>0.971</td>
<td>1.031</td>
<td>1.216</td>
<td>1.014</td>
<td>0.697</td>
<td>1.032</td>
<td>1.127</td>
<td>1.036</td>
<td>0.805</td>
</tr>
<tr>
<td>Three-star</td>
<td>0.751</td>
<td>1.025</td>
<td>1.045</td>
<td>0.860</td>
<td>1.197</td>
<td>1.128</td>
<td>0.961</td>
<td>0.885</td>
<td>0.888</td>
<td>1.072</td>
<td>1.035</td>
<td>0.702</td>
</tr>
<tr>
<td>Two-star</td>
<td>0.456</td>
<td>1.396</td>
<td>1.177</td>
<td>1.217</td>
<td>1.203</td>
<td>1.103</td>
<td>1.103</td>
<td>0.831</td>
<td>0.497</td>
<td>1.518</td>
<td>1.324</td>
<td>1.036</td>
</tr>
<tr>
<td>One-star</td>
<td>0.266</td>
<td>0.447</td>
<td>1.229</td>
<td>1.320</td>
<td>0.132</td>
<td>0.788</td>
<td>2.117</td>
<td>1.232</td>
<td>0.263</td>
<td>0.603</td>
<td>1.576</td>
<td>1.094</td>
</tr>
<tr>
<td>Mean value</td>
<td>1.100</td>
<td>1.048</td>
<td>1.039</td>
<td>1.144</td>
<td>1.065</td>
<td>0.927</td>
<td>2.270</td>
<td>0.907</td>
<td>1.029</td>
<td>1.166</td>
<td>1.235</td>
<td>0.885</td>
</tr>
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Table 4: Average Malmquist index and decomposition of service innovation efficiency by year for star hotels, 2015–2019.

<table>
<thead>
<tr>
<th>Year</th>
<th>Effch</th>
<th>Tech</th>
<th>Prech</th>
<th>Sech</th>
<th>Tfp</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015–2016</td>
<td>1.100</td>
<td>1.065</td>
<td>0.985</td>
<td>1.137</td>
<td>1.029</td>
</tr>
<tr>
<td>2016–2017</td>
<td>1.048</td>
<td>0.927</td>
<td>1.522</td>
<td>0.838</td>
<td>1.166</td>
</tr>
<tr>
<td>2017–2018</td>
<td>1.039</td>
<td>2.270</td>
<td>0.871</td>
<td>1.606</td>
<td>1.235</td>
</tr>
<tr>
<td>2018–2019</td>
<td>1.144</td>
<td>0.907</td>
<td>1.006</td>
<td>1.141</td>
<td>0.885</td>
</tr>
<tr>
<td>Mean value</td>
<td>1.083</td>
<td>1.292</td>
<td>1.096</td>
<td>1.235</td>
<td>1.079</td>
</tr>
</tbody>
</table>
Figure 4 and Table 5 reveal that the combined technical efficiency and technological progress indices of four-star and two-star hotels show less variation, with values almost overlapping, and that the efficiency of service innovation is less influenced by them and develops more steadily. This is due to the more advanced technology of five-star hotels and sufficient management talents, making their management level and resource allocation ability much better than other star-rated hotels. The service innovation efficiency of three-star hotels is less than 1, which is due to pure technical efficiency. Therefore, it is necessary to upgrade the hardware facilities of star hotels, reasonably allocate effective resources and constantly attract management talents, so as to improve the management level of star hotels and enable the star hotel industry to develop rapidly. The service innovation efficiency and comprehensive technical efficiency of one-star hotels are both less than one, and the pure technical efficiency has reached a DEA effective state, which means that its allocation and use of resources are reasonable, but the industrial scale has not reached the optimum, thus the scale efficiency is invalid, which makes the comprehensive technical efficiency also invalid, therefore, the key is to control the scale of star hotels and strive to reach the optimum industrial-scale state, so as to make the service innovation efficiency. Therefore, the key is to control the scale of star hotels and strive to achieve the optimal industrial-scale state, so that the efficiency of service innovation can reach DEA effectiveness, thus promoting the healthy and sustainable development of one-star hotels.

The hotel industry is facing an unprecedented crisis because of the epidemic. It is very important to analyze the service innovation efficiency of all-star hotels in China from 2020 to 2021 after the epidemic. As the hotel industry is facing a severe market situation, some low-star hotels are eliminated, while one-star hotels are most affected by it, and the indicators are far from other star hotels. Therefore, this time, only Malmquist index of service innovation efficiency of two-star to five-star hotels in China after the epidemic is selected for analysis.

As can be seen from Table 6 and Figure 5, only three-star hotels have service innovation efficiency greater than 1, reaching the DEA effective state. This is because domestic hotel industry has entered the development period of mid-range hotels after the epidemic, and the production technology and management level of three-star hotels have been improved, and the pure technical efficiency has been improved. The scale mainly inhibits the service innovation efficiency of five-star hotels and two-star hotels. After the epidemic, single hotels are retired, and all hotels are faced with reorganization to keep warm. However, the scale efficiency DEA is invalid because the industrial scale is not optimal. Therefore, it is necessary to realize the optimal allocation of industrial production factors and improve the service innovation efficiency from scale to quality. Generally speaking, the pure technical efficiency of all-star-rated hotels is in DEA effective state after the epidemic. As the epidemic affects the hotel industry’s operation, all-star-rated hotels have to improve the resource utilization, change their thinking, and adjust their operation mode to improve the pure technical efficiency.
5. Conclusion

This paper has conducted an empirical study on the efficiency of service innovation in star-rated hotels in China by using the DEA-Malmquist index method and has come to the following conclusions: (1) the service innovation efficiency of high-star hotels shows higher sensitivity to the external environment, and its fluctuation magnitude is comparatively obvious when the environment changes greatly; low-star hotels show a relatively persistent vitality under the unfavorable external environment; (2) technological progress is an important promotion of the service innovation efficiency reason, and its promotion of service innovation efficiency is greater than the hindrance of comprehensive technical efficiency; (3) technological advances are a key reason for the increased efficiency of service innovation in five-star hotels, pure technical efficiency will hinder the service innovation efficiency of three-star hotels to a certain extent, for one-star hotels, pure technical efficiency has an obvious promotion effect on the improvement of service innovation efficiency, and scale efficiency has a service innovation efficiency improvement has a certain inhibiting effect. (4) After the epidemic, pure technical efficiency can obviously promote the service innovation efficiency.

For high-star hotels, technological progress and management efficiency have relatively obvious advantages, but they are susceptible to external environmental changes and unexpected events. In the subsequent development, they should strengthen the construction of environmental monitoring mechanisms and enhance the ability to deal with unexpected events, while strengthening investment risk management and expanding their multiregional investment portfolios to reduce the impact of unexpected events and environmental changes on the total factor productivity of hotels. For low-star hotels, the comparative advantages of technology and management levels are not obvious. In future development, it is important to improve the scientific level of investment, prevent the impact of scale expansion on the efficiency of service innovation, moderate the application of advanced technology, product, and service innovation, and improve the efficiency of management and operation.

To improve the efficiency of service innovation in China’s star-rated hotel industry, the government should step up its planning and implement measures in different categories. First, government departments should increase policy encouragement, introduce supporting industrial measures, and implement subsidies for technological innovation in the hotel industry, so as to play a good role in government leverage and traction to improve the efficiency of service innovation. Second, based on coordinated development, the government should strengthen the layout of the industry, especially increase the efforts to support medium- and low-star hotels, so as to build a balanced development of China’s star hotel industry and to prevent excessive competition or indiscriminate expansion leading to waste of resources and duplication of investment [20, 16].

Data Availability

The data used to support the findings can be obtained from “https://mct.gov.cn/.” Also, the data can be found by searching the website directly for the Starred Hotel Statistics report and viewing the analysis.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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8 Mathematical Problems in Engineering


