

Article

Supporting Luxury Hotel Recovered in Times of COVID-19 by Applying TRIZ Method: A Case Study in Taiwan

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Abstract: The current COVID-19 pandemic, which is alarming for another global economic recession, puts the sustainable development of the tourism system under high consideration. The tourism industry is a key generator of foreign exchange across the region. However, tourism is one of the sectors most affected by the global pandemic. Through a case study in Taiwan, the objective of this study is to show how an Evergreen hotel fixed itself on existing and recovering in the hospitality business during the COVID-19 pandemic in 2020 using the combination of the problem hierarchy analysis (PHA) and the Teoriya Resheniya Izobreatatelskih Zadatch (TRIZ) or the so-called theory of inventive problem-solving technique. Following PHA technique and extensive investigation, the management team determined that the most recent problems at the Evergreen hotel are in marketing and human resources. The 39 parameters and 40 principles of TRIZ were used to determine the improvement solution and create a solution strategy that simultaneously simplified critical control-point (CCP) processes and improved the correctness of tasks, increasing CCP efficiency and supporting and satisfying customer demands in the COVID-19 pandemic in the world in general and in Taiwan in particular. The results revealed that customer bookings grew over the four quarters of 2020 due to adjusting the cancellation policy, discounting, and segmenting the market from international to domestic, increasing the CCP efficiency percentage and customer rating score from 19% to 40% and 8.3 to 8.5 score, respectively. Aside from that, changing the hotel structure with a partnership with the Taixie company assisted Evergreen in reducing various cost pressures to manage the business and recover after a difficult period. This paper can be a useful reference for managers, investors, governments, and policymakers to improve the sustainability performance in the tourism industry.

Keywords: luxury hotel; COVID-19; marketing; human resource; efficiency; TRIZ; decision making



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1. Introduction

The world is currently fighting a global infectious pandemic known as COVID-19, which started in December 2019 [1]. Not only has the global healthcare system been put in a state of emergency, but the global economy is also predicted to suffer. To stop the spreading of the coronavirus, limitation on human interactions is reported to be a feasible measure that is commonly applied across countries and regions [2]. The main activities comprising this limitation can be listed as social distancing, lockdown, border closure, home quarantine, and school closures, with different levels of compliance. Despite the effectiveness, the impact of these measures together with the current burden of the healthcare system has increased vividly in both micro and macroeconomics. Fernandes et al. [3] conducted a review and forecasted the effect of this pandemic. Due to the uncertainty of lockdown duration and the recovery, the study predicts that the GDP growth can be decreased from

2.8% in mild scenarios and up to 15% in a critical situation. The study also discussed the industries at risk, such as tourism and supply chain. As a result, Fernandes estimated each additional month of crisis costs 2.5–3% of global GDP.

Hospitality has grown steadily in recent decades, becoming one of the fastest expanding economic sectors, including Taiwan. According to the UNWTO's March projection, the sector has seen a 59% increase in international tourist arrivals over the last decade, from 880 million in 2009 to 1.5 billion in 2019. With tourist-specific improvements in increasing national and international destinations, tourism is also a vital driver of socioeconomic progress. In 2019, the tourist business provided USD 8.9 trillion to global GDP, a contribution of 10.3%. However, because of the global COVID-19 epidemic, significant historical growth ended in 2020. Since the beginning of the virus's spread, travel and tourism has been one of the most affected sectors, with planes grounded for extended periods, hotels closed, and travel restrictions imposed [4].

As a result of the COVID-19 outbreak, numerous businesses in the hospitality industry in Taiwan were stymied and disrupted, particularly for overseas businesses. The pandemic imposed a travel ban on overseas tourists in February 2020, with only Taiwanese being allowed to return to their homeland. Following the COVID-19 pandemic outbreak in the first two quarters of 2020, the UNWTO report estimated that at least 93% of global citizens were in countries with coronavirus-related travel restrictions, with approximately three billion people living in countries that enforced complete border closure to foreigners. However, in Taiwan in 2020, with perfect supervision, an Evergreen hotel (Chiayi), part of the Evergreen group's Taiwanese chain, decided to reform the system to safeguard the company and help it recover from the difficult period. There have already been successful critical control-point (CCP) experiences with private sector participation [5]. At the moment, the Taiwanese business is mostly focused on domestic clients.

It is important for hotel sales and marketing to understand customer behavior to create effective marketing [6] because the rule of kind of business will depend on the number of selling bookings and the price of booking to earn the net income. Evergreen is a large corporation with a large chain of 5-star hotels that spans the globe to lead high-level customers, such as international businessmen and high-class customers in other countries. COVID-19, in 2020 when it first emerged, posed a significant challenge to Taiwan's 5-star hotels, especially Evergreen hotels. Due to closing the border, nearly all 5-star hotels were forced to close their doors because of increased cancellations and a lack of new bookings until an unforeseeable time. However, due to the government's strong control over diseases and analysis of hotel-recovery tactics in Taiwan [7], Evergreen hotels decided to continue operating to get through the difficult COVID-19 period by breaking the old, firm structure to follow the new segment customers (domestic customers) in Taiwan and innovating the old standard operating procedure (SOP) to address the new needs from the government. Despite being a large corporation in a challenging circumstance, Evergreen has managed to endure and develop steadily throughout time.

The Teoriya Resheniya Izobreatatelskih Zadatch (TRIZ) or so-called theory of inventive problem-solving technique, in particular, was created to solve problems relating to manufacturing systems. However, in recent times, a new TRIZ-based technique for improving service quality has been suggested to the service industry. For example, Su et al. [8] used TRIZ and fuzzy quality function deployment (QFD) to generate creative solutions for service quality improvement with a case study in an e-commerce company. In this paper, fuzzy QFD is applied to identify the critical determinants relating to customer satisfaction. Then, in the TRIZ contradiction matrix, the related TRIZ engineering parameters may be successfully employed to identify the creative concepts. Furthermore, Lin and Su [9] applied TRIZ to identify the corresponding inventive principles with a sample case of a company that provides online application software services in Taiwan. In order to reason about the issues among relevant stakeholders in the tourism industry, Chang and Wu [10] used TRIZ and decision-making trial and evaluation laboratory (DEMATEL) to clarify the complicated relationship results generated by conflicting challenges across sectors to

resolve contradictions and innovative principles and to establish the extent of influence between innovation principles and which principles have had the most significant impact. Furthermore, conversion policies and tourism regulations were considered for the performance of the tourism industry in the current pandemic.

Because of COVID-19, researchers have focused on studying the hospitality scenario, but no example has focused on the CCP of a luxury hotel, such as Evergreen. During the most difficult period of COVID-19, the Evergreen hotel focused on developing a new technique to increase bookings from high-end domestic consumers starting in Q3 of 2020 at the lowest possible cost. The purpose of this study is to employ Teoriya Resheniya Izo-breataelskih Zadatch (TRIZ) contradiction matrix to identify the key issues with domestic customers' booking habits and old SOP produced by the marketing and manager departments during the COVID-19 period. Following that, 39 parameters and 40 principles were used to find the best solutions or approaches for improving CCP processes, the correctness of new SOP tasks, and company structure, effectively supporting all Taiwan hotel-repair missions and meeting fleet maintenance and servicing demands in order to recover from the economic effects COVID-19 and other diseases.

The rest of the paper is organized as follows: Section 2 presents the literature review, while Section 3 elaborates the methodologies, including problem hierarchy analysis and TRIZ innovation approaches. Section 4 presents the empirical analysis with a case study of the Evergreen hotel chain in Taiwan. Lastly, Section 5 gives the discussions, concluding remarks, and limitations and suggests future work directions.

2. Literature Review

As the coronavirus (COVID-19) has shown, natural disasters and tourism have a history together [11]. Because of on-pharmaceutical interventions, lack of a vaccine, and minimal medical capacity to cure the disease, COVID-19 knocked out all of the world's tourists from 2019 until late 2020 [12,13]. COVID-19 causes public panic, which leads to reduced demand and lower customer demand prices, and the price of the tourist industry continued to fall in lockstep with the decline in demand [14–16]. On many levels, the government played a vital role in the fight against the COVID-19 before things get out of hand by sponsoring loans with no interest to help businesses get through this difficult period [17]. In COVID-19's impact on tourism, control of tourism activities, disputes, and solutions, government assistance is among the key themes identified during this difficult period of time globally [18]. Besides, the image of a place influences visit intention and mediates the relationship between the determinants and visit intention [19]. After that, many people utilize the Internet for travel planning, such as travel information search and booking [20].

Many sorts of research were conducted to identify effective marketing techniques and unique products that might be used to reach and enter a new market or increase value quickly. As a result, benefit segmentation is influenced by the design and modification of attractions, such as part of the product holiday packaging or activity programming [21]. Then, customers' price expectations are how to acquire products that fit their quality expectations, and they may even receive an offer that exceeds their initial expectations. Market segmentation is not focused on increasing or improving profit; rather, it is viewed as a strong strategic notion for achieving long-term financial goals and limiting the risk of a long-term plan [22].

Some studies have found that while there are many distinct forms of crises and disasters, and each incident is likely to be unique, it is critical to document as much information as possible to better anticipate future possibilities [23]. The high number of essays about this special issue reflects the desire for people to express themselves as a way of releasing their fears and integrating their hopes in the wake of the COVID-19 pandemic [24]. Sobaih et al. [25] investigated the direct impact of small hospitality company resilience on sustainable tourism growth as well as the indirect influence via performance. Besides, Rahman et al. [26] studied the influence of the COVID-19 outbreak on visitors'

views of travel risk and management. The data show that the COVID-19 epidemic has had a significant impact on travel risk and management attitudes. The COVID-19 epidemic has had an impact on the tourist sector owing to travel restrictions and a drop in demand among travelers. To negotiate the uncharted territory created by the epidemic, hotels must re-evaluate current business processes and establish new and inventive tactics that protect the health and safety of guests as well as staff and, as a consequence, restore customer trust [27].

One of the effective methods widely used for process improvement in industries or services is the TRIZ approach (so-called *Teoriya Resheniya Izobreatatelskih Zadatch* or the theory of inventive problem-solving technique). TRIZ has the potential not only to anticipate but also to invent new approaches. Because of its structure and algorithmic approach, TRIZ also delivers repeatability, predictability, and reliability. Some applications of TRIZ, such as that of Wang et al. [28], commended TRIZ in steel manufacturing to improve the design of the tester, which may cause severe oxidation of zinc to solve the oxidation problem. Feniser et al. [29] proposed TRIZ to discuss the concepts of sustainability, innovation, and risk management in small- and medium-sized enterprises (SMEs) to develop a flow chart for evaluating the state of innovation in such companies. Through the use of the TRIZ method in the field of SMEs, fast and efficient processes, products, and sustainable services have been obtained. Renjith et al. [30] merged axiomatic design with TRIZ to redesign the housing cover of design for additive manufacturing in additive manufacturing. The results showed that the redesigned part had improvements in structural properties, and the proposed design framework can be effectively used to transform an original product design for traditional manufacturing into a new method suitable for additive manufacturing by incorporating the additive manufacturing capabilities into the product design. Wang et al. [31] used TRIZ to improve chip sidewall crack issue in the nanometer packing process of semiconductors caused by a poor laser waveform during the laser cutting process, resulting in debris along the chip sidewall. Lin and Chen [32] executed TRIZ with supply chain management in new product development for SMEs of Taiwan. The study explored practical alternatives for SMEs to develop various value-added products that meet customers' changing requirements and succeed in competitive markets to achieve a sustainable business operation. Ramírez-Rios et al. [33] conducted TRIZ in the plantar orthosis field that designed a support device for the foot. Yang and Tsai [34] mingled TRIZ, failure modes and effects analysis (FMEA), and Internet of Things (IoT) to explore research and application of energy management in industry 4.0 with a case study is the semiconductor manufacturing of Taiwan.

During the COVID-19 period, hotels provide the most services, such as offering a price comparable to competitors as well as low-cost rooms and discounts [35]. As a result, the COVID-19 management framework was presented with digital and intelligent transformation and market upheaval to cover the anti-pandemic phases. Marketers seek out guests who will spend money rather than merely time on their tourism offerings to increase their market share [36,37]. Tourist hotels in Taiwan are focusing on enhancing customer service quality. Human resource management (HRM) techniques can help a company develop an environment that supports positive employee behavior and improves service quality. Their study aimed to investigate the relationship between human resource management methods, service behavior, and service quality in tourist hotels experimentally. HRM practices were discovered to directly impact consumer perceptions of service quality. The ramifications of their findings for HRM and future research were highlighted [38]. Chand [39] looked into the impact of HRM practices on service quality, customer satisfaction, and hotel performance.

This paper analyzes a concrete situation generated by the pandemic and look for the future forecast of Evergreen Hotel to attract new customers, keep order bookings, and fulfill requirements. Problem Hierarchy Analysis (PHA) has two directions of research: the first is to analyze the larger demand, and the second is to narrow down the specific difficulty. The contradiction matrix *Teoriya Resheniya Izo breatatelskih Zadatch* (TRIZ) is

used as a method to identify issues related to the habits of domestic customers regarding reservations and the old standard operating procedure (SOP) used by the marketing and management departments during the pandemic period. By analyzing and forecasting the future of the Evergreen hotel based on the financial situation and marketing department results in Q1 and Q2 of 2020 and the new regulars of Taiwan Government for safety during 2020 with relevant customers' requirements, the purpose of this paper is to analyze and forecast the future of the Evergreen hotel to attract new customers, keep ordered bookings, and fulfill requirements. Based on the results of this study, the Evergreen hotel decided to attract investors by revising the old running systems to adapt to the recent crisis time; expanding the market from international customers to domestic customers through discounts; and repairing, adding, and changing hotel equipment, such as infrared thermometers, room partitions, and plastic masks, to satisfy customers. As the result's proposal, the management team is responsible for making choices based on the marketing and financial department's reports and projecting future trends and plans to ensure that the hotel's operation runs smoothly. Evergreen created a new design of the application due to modifying the structure of marketing and HR strategy. The proposed system's efficiency and benefits are demonstrated through this study.

3. Methodology Approaches

3.1. Problem Hierarchy Analysis (PHA)

Problem Hierarchy Analysis (PHA) is a powerful tool for identifying hazards early in the design process for problem solving. PHA is a requirement of the MIL-STD-882D concerning Standard Practice for System Safety, according to the CCPS Hazard Evaluation Guidelines by Kavarianian, Rao, and Brown (1992) [40]. The structure of the PHA is shown in Figure 1. There are two parts to the research: the first is to analyze the larger demand, and the second is to narrow down the specific difficulty. The PHA can solve a company's shortage of points to fix business difficulties, train new visions, and identify better points to establish a new environment. PHA assists us in determining the most important things to address. That we might identify and label the source of the problem with a hasty decision is not the primary error or omission to consider and address. We must genuinely comprehend the core issues that lie beneath the surface issues. The working approach for this study consists primarily of gathering data from the hospitality business and all connected documentation. The approach for this investigation is given in Figure 1 after confirming the subject and starting with the industrial analysis.

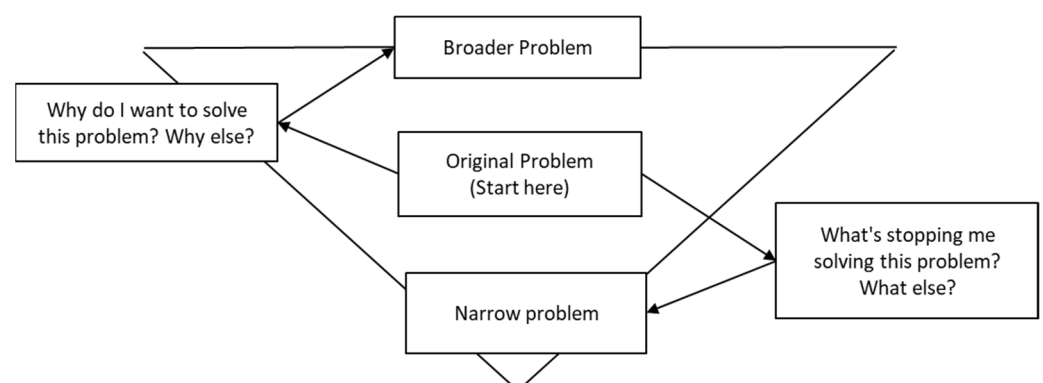


Figure 1. Problem hierarchy analysis structure [41].

3.2. TRIZ Methodology

The methodology used in the study is called Teoriya Resheniya Izobreatatelskih Zadatch (TRIZ), and it was created by a Russian engineer and inventor named Altshuller in 1946. TRIZ was a process developed by Altshuller, who reviewed over 200,000 patents and synthesized the information, resulting in 40 invention principles that became the foundation of TRIZ in 1950 [41]. TRIZ is a systematic paradigm that converts a specific

problem into a general issue, outlines a generic outcome from patents, and returns to the original problem. TRIZ includes problem hierarchy analysis, substance-field analysis, evolution trends, 40 innovative concepts, and resources. The key challenges were first identified using a problem hierarchy analysis. The 40 principles were then used to identify the best improvement solution or approach and develop a solution plan that simplified and improved the accuracy of procurement chores while still meeting fleet maintenance and servicing demands.

Forty Principles and Contradictory Matrix: The core premise of TRIZ is to follow the rule of the 40 innovative principles represented in over 200,000 patents. One of the major principles in TRIZ is the contradiction, which is used to formulate challenges and signal a truly unique approach. The resolution of contradictions is a basic TRIZ idea. In TRIZ, there are two types of paradoxes: technical and physical contradictions. When using TRIZ, one of the contradictions is that if we enhance one system parameter, at least one other value will deteriorate. The 40 principles are then applied to resolve the technical inconsistencies. TRIZ normally addresses problems using a two-dimensional contradiction matrix. The matrix row reflects what is keeping things from becoming better, and the column expresses what we wish to improve [41].

In a system, a technical contradiction occurs when one parameter, “A”, is modified, while the other, “B”, is changed at the same time, for example, in a car system, power vs. fuel consumption and weight vs. strength. The contradiction matrix and the corresponding innovative concepts can be used to solve technical contradiction situations. The TRIZ approach was used to find solutions after understanding these concepts. By eliminating the contradiction, it improves one parameter, “A”, without hurting the other parameter, “B”. The problem solving by contradiction matrix in TRIZ methodology is presented in Figure 2 [42].

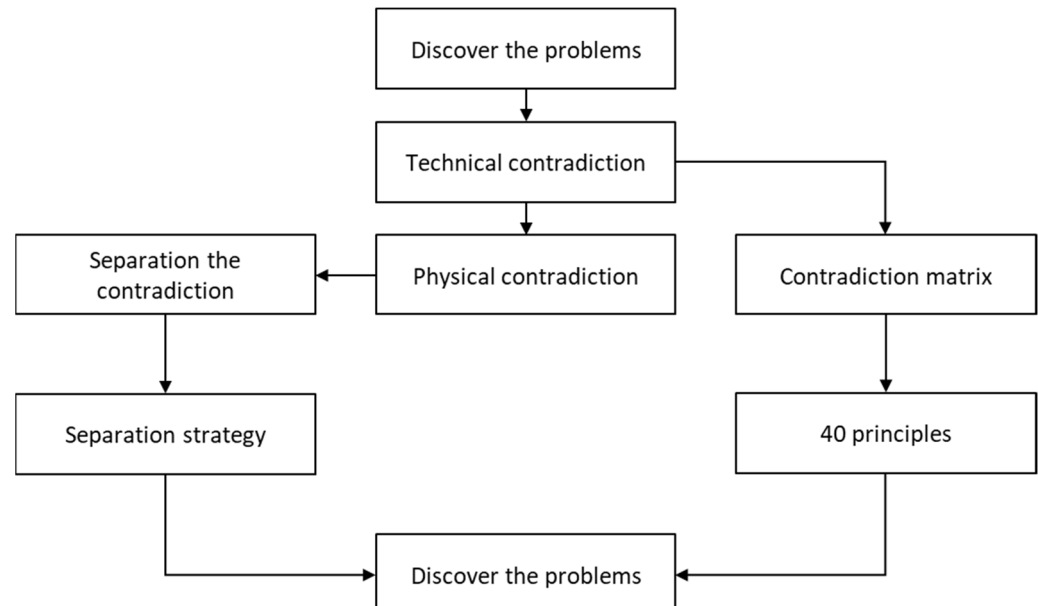


Figure 2. The problem solving by contradiction matrix in TRIZ methodology.

4. Case Study

4.1. Current State

The Evergreen Group was founded in 1968. Over 50 years, it has grown into a large corporation with investments in various industries and nations, including shipping, hospitality, and airlines, among others. The Evergreen Group decided to diversify its business from shipping to include air transportation, hotels, and leisure services as part of its expansion strategy. Evergreen International Hotels was formed to allow international tourists to enjoy better Evergreen Group service by satisfying clients from Evergreen

Eva flights and differentiating imported goods from shipping techniques. With a global presence and a diverse range of services, the Evergreen Group provides domestic and international customers with quick and dependable sea, land, and air freight services as well as safe, comfortable, and convenient air transportation.

Parallel to its booming airline industry, it has built up a huge transportation network and constructed a chain of worldwide hotels over the last 50 years. Evergreen Laurel's name honors the aesthetic heights attained by Europe's poet laureates, whose work continues to inspire humanity. All Evergreen International Hotels ensure a comfortable, warm, safe, and clean stay as a guarantee to guests. Evergreen International Hotels is a large hotel chain with Keelung, Taipei, Taichung, Tainan, Chiayi, Yilan, Paris, Penang, Bangkok, and Shanghai locations.

All the case study data come from the Evergreen hotel of Taiwan's Evergreen corporation. This is a real project to help hotels survive during the COVID-19 situation. This study is focused on limiting canceled booking, increasing new booking from customers by replacing some old processes and strategies in the hotel, and reducing the cost to run a hotel's business during difficult times. The following four-step coordination process is shown in Figure 3 and described as follows.

1. All of the bookings of customers will be divided into two types: canceled booking and new booking. Because the COVID-19 situation suddenly became worse, many companies in Taiwan were frozen from February 2020. In the hotel tourism industry, many from January 2020 were still saved in the hotel's booking system. The Evergreen hotel aims to keep the old customers and boost the number of new customers booking for next months. Therefore, the finance department has to analyze and report to the company daily about the recent situation and the emergency plan to apply in the hotel to reduce the cost for at least six months. The plan should clarify the requirements of the three maintenance levels, such as safe, effective, and stable, and the review of requirements for investors should be completed in one month before the target year.
2. Marketing and finance officials are guided to submit their requisitions to relevant project managers. All acquisition requests need to be updated every day, appointing dedicated personnel to each request and reviewing the department's integrity of the requests submitted. The review outcomes are returned to the requesting departments for review, revision, and confirmation. After analyzing that in March, Taiwan decided to close the borders to decrease the number of disease cases in the world. Going out of the country for traveling became so difficult that hotels have decided to focus on domestic traveling. That meant, from June to August in 2020, a large number of domestic customers can book the hotels for traveling. Because of the chance, the hotel has to prepare and create a safe environment for new customers (cleanness, privacy, safe distance, etc.) and change the time to arrive for the canceled booking of customers.
3. The finance office must give the results of investors to the company to review and decide which company could become the partner of the Evergreen hotel, could support the hotel during the no-benefit period, and support the hotel in the busiest time in one to two months.
4. All the new benefits of canceling the rooms' rules and booking rooms will be posted on the internet to attract customers. The number of canceled bookings will be controlled with the customer care office or hotel's hotline and saved with its code. Marketing and finance plans will be sent to all potential investors to attract cooperation by email and directly operated by executives and high-level companies. Failed SOP failed is collated into a list and returned to the original requesting department for review: unaccepted canceled bookings will be passed to the booking department to review and reported to the front desk to help customers choose their other options.

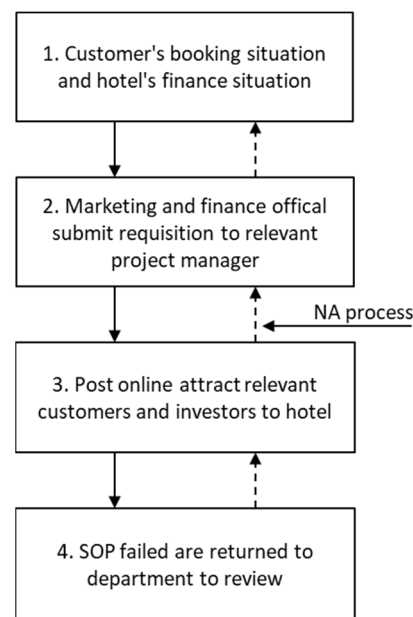


Figure 3. The current process of booking rooms before improvement.

4.2. Problem Description

This study adopted the problem hierarchy analysis (PHA) to analyze the research problem, which is expanded, narrowed, and repeatedly analyzed to formulate an efficient flowchart for improving the performance of the Evergreen hotel during the pandemic crisis. The flowchart was then used to analyze demand and process descriptions (Figure 4).

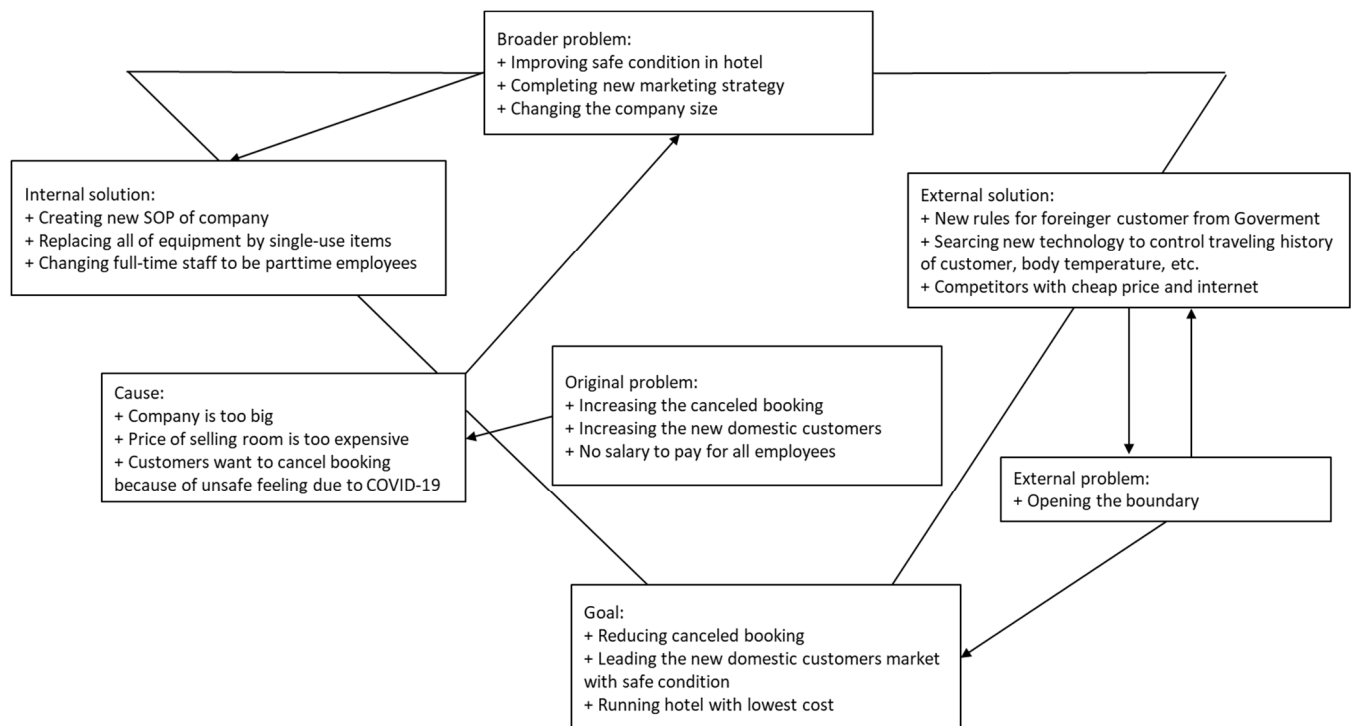


Figure 4. The problem hierarchy analysis of the Evergreen hotel.

The TRIZ problem hierarchy analysis of Figure 4 was adopted to elucidate the following aspects of the process:

- **The original problem:**

Because of COVID-19, almost all hotels in Taiwan could not be safe for travel, so the number of bookings for hotels suddenly decreased during March, April, and May of 2020. Thus, many big and medium hotels were closed and interrupted because of canceled booking, and no customers could travel. Therefore, many companies encountered trouble with finance to run the business with unpredicted ending times for the restrictions.

- **Cause:**

Having many canceled bookings should be solved with flexible methods; zero new and old bookings from foreign customers, which play an important role in the hotel's benefits, will affect the hotel seriously, especially Evergreen 5-star hotels.

- **Broader problem:**

Hotels need to improve their safe condition and create a completely new strategy.

- **Internal Solution:**

Creating a new SOP plays an important role in hotels during the COVID-19 period. The old SOP process now needs to add a safer process, such as all the equipment and items for customers should change to single-use and be sprayed by disinfectant water.

Hotels need to create a safer environment with new cleaning levels during working times, add screenings to check body temperature, and make wearing a mask a mandatory condition during the COVID-19 pandemic for areas such as hotel check-in desks, where people might gather together. Therefore, providing personal protective equipment (PPE), such as face masks and gloves, could be a new service of hotels to keep staff and guests protected or ensure the distance (1.5 to 2 m) between two people will be applied at any given time.

For the safety conditions, employees should divide into two shifts day and night, and unnecessary staff should be changed to part-time work or fired during the period. According to a review of the research, isolation can be mitigated by having a strong social support network. Video conversations and virtual meetings allow social interactions despite physical distance [43,44].

- **External Solution:**

Security: With the new rules to protect customers and employees of hotels, travelers and guests need to perform all safety and hygiene measures as a priority, with strict cleaning protocols to deal with the coronavirus, such as filling out a form of history traveling information for two weeks; measuring body temperature at two times, namely at arriving and leaving the hotel; and performing disinfection before touching any equipment or people in the hotel.

Flexibility: When customers decide to book hotels, there should be more flexibility and importance. All the new policies need to be updated consecutively to adapt to unpredicted changes, such as time for business meetings or staying, that will need to be delayed because of sudden travel restrictions. Giving the flexibility conditions for the customer, they could gain more confidence in facing the fear of isolation situations, the closing of borders, and transportation cancellations.

Hospitality: The hotel must have a good relationship with online travel agencies, which display clear and simple updated information of the new policy for COVID-19 on the listings of hotels. The hotel must explain the information, such as the time to answer hotel inquiries, the hotel's current COVID-19 cases, safe transfers from the airport to the hotel and vice versa, museum tickets, etc.

- **Goal:**

Hotels could prepare well with investors with many canceled bookings, and new bookings could be transferred to June 2020. This study revealed that revising domestic traveling could be the trend of the years, and opportunities could come from this point. Therefore, project managers should verify the sources and price for marketing for bookings

and investors should modify or supplement necessary and unnecessary plans. Moreover, project managers' business analysis abilities and knowledge toward the detailed plan should be fostered to improve the efficiency of hotels.

5. Results Analysis

5.1. Application of 40 Principles of TRIZ

TRIZ is a problem-solving strategy focused on logic and data rather than intuition, helping the project team solve challenges more creatively. The TRIZ 40-principles method was adopted in this study to identify the causes of the related problems and the possible solution for improving the hotel's performance in the COVID-19 period. In order to analyze the feasibility of the suggested principles obtained from the matrix of contradictions, they were crossed with the existing approaches. The selected principles were proposed for acceptance and were executed by the hotel. The objective is to determine contradictions for the problem and match them with appropriate parameters from the 39 engineering parameters and 40 innovative principles defined in the matrix [45]. A brainstorming session identified the following major contradictions in the system, where # denotes the TRIZ engineering parameter number. A contradiction matrix was created for the 29 solutions as tabulated in Table 1.

Table 1. The contradiction matrix of the paper.

Improving Parameters	Worsening Parameters				
	Duration of Action of Moving Object: 15	Temperature: 17	Power: 21	Loss of Information: 24	Object-Generated Harmful Factors: 31
Stress or pressure: 11	19, 3, 27	35, 39, 19, 2	4, 6, 2		3, 5, 1
Stability of object's composition: 13	13, 27, 10, 35	35, 1, 32	32, 35, 27, 31		35, 40, 27, 39
Duration of action of moving object: 15		19, 35, 39	19, 10, 35, 38	10	21, 39, 16, 22
Object-affected harmful factors: 30	22, 15, 33, 28	22, 33, 35, 2	19, 22, 31, 2	22, 10, 2	
Ease of operation: 33	29, 3, 8, 25	26, 27, 13	35, 34, 2, 10	4, 10, 27, 22	
Ease of repair: 34	11, 29, 28, 27	4, 10	15, 10, 32, 2		

In the evaluation stage, the suggested principles obtained from the contradiction matrix were cross-referenced with the actual approaches to analyze the feasibility of the suggested principles. After discussing with the hotel management team, some inappropriate approaches were eliminated. The segmentation principle (#1), taking out (#2), blessing in disguise (#22), and cheap short-term living object (#27) were adopted to enhance the number of bookings for hotels during the COVID-19 period. Upon the discussion the hotel management team, this study came out with some actions for improvement, and the hotel management team agreed to follow and execute these actions. The details are listed below.

The segmentation (#1): The target is divided into several independent parts. All the types of the booking will be divided into two groups. Specifically, the requested cancellations are priority cases that need to be solved as soon as possible. Subcategorizing categories facilitate price negotiations and reduce the ability of canceled bookings. The booking system will monitor and control the new booking to help customers update to the new price and new rules during COVID-19 time. Therefore, the company makes this object easy to disassemble, such as eliminating the full-time staff and cooperating with potential investors to share and maintain the benefits together. All of the staff passed the requirements to be kept by hotels, and the entire will be transferred to part-time staff. After a miniature business model, hotels could cooperate with investors in the same situation to cover all hotels. The plan helps hotels survive during COVID-19 with lower costs to run

the business and enough staff with good skills during the summer vacation and holidays without training costs.

Taking out (#2): The company changes an object's structure from uniform to non-uniform, changing an external environment (or external influence) from uniform to non-uniform, such as flexible working hours. Because of protecting the safe environment during the risk of COVID-19, all employees are arranged in differential working shifts and could not change flexibly. Therefore, hotels open or recommend their factory or distribution, entertainment centers near hotels, such as shopping malls, cafeterias, bakeries, and convenience stores, to customers to control the schedule of customers efficiency.

Blessing in disguise (#22): The company uses the method named loss-leader strategy for increasing sales. Evergreen is a 5-star hotel, and almost all the benefits are from foreign customers, so it uses expensive equipment and luxury items to service customers. However, in a complicated situation, the company needs to decide to change all the old habits. To keep the standard of 5-star hotels that can still compete with many small hotels, some items inside hotels are replaced with items at cheaper prices. Using protection environment trends, Evergreen will change to items made of recyclable materials or reduce the use of expensive but unnecessary items during the time. Moreover, eliminating the fear of change by introducing fear of competition is effective. Evergreen decided to share 20 to 50% benefit with the investor named Tai-Xie to raise the competitive environment in a work place with two targets, in which our employees will work with higher productivity and reduce the cost to run the business in this time. Approving the other company's access inside Evergreen's own company is harmful because it will constitute two systems running together in a company but will lead to benefits, also.

Cheap short-term living object (#27): The target of hotels is to replace an expensive object with multiple inexpensive objects that will not compromise certain qualities, such as service life, for instance, too much. Moreover, all the big spaces inside hotels must be divided into closed and small spaces to adapt to government rules and let customers have their own space to protect customers' health. During COVID-19, hotels would like to attract short-term customers to stay in hotels, so they must control and limit the contact between people and people in the large areas and practice sterilization as a routine.

5.2. Verifying the Efficiency of Study

A flowchart of the improved booking and HR system for cutting cost and gaining a new segment market of the Evergreen hotel during the COVID-19 period is illustrated in Figure 5 and described as follows:

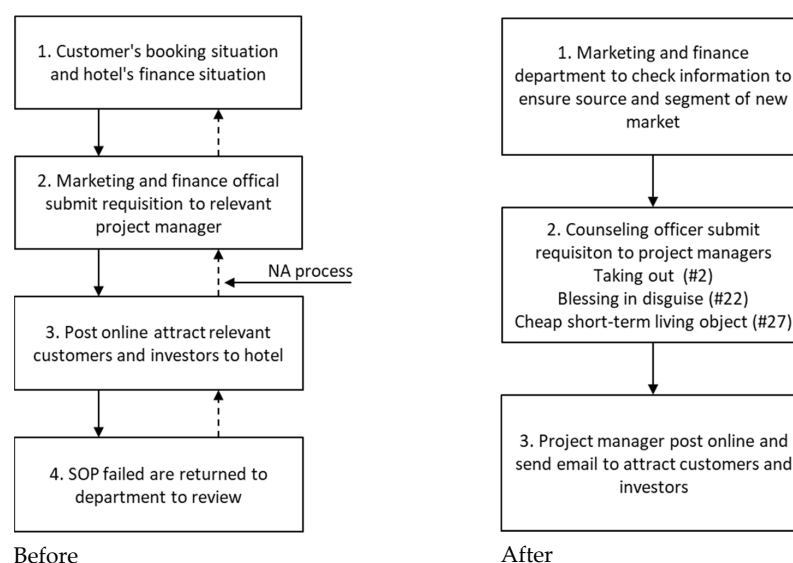


Figure 5. The process of booking rooms before and after improvement.

1. Before submitting a requisition, the requesting departments, such as the marketing and finance department, should cross-reference the coordination and procurement of the canceled and new customers' or investors' information to ensure the market sources. This process enables the requesting departments to revise system information immediately, saving at least three working days to revise management information by #1 segmentation.
2. The counseling officer submits the requisition to project managers in segments based on the requesting department: the requesting department allocates the procurement cases to dedicated projects depending on the department type. Moreover, subcategorizing spare-part categories facilitates price negotiations and quotes: #2 taking out, #22 blessing in disguise, and #27 cheap short-term living.
3. Projects are then posted online, and emails are sent to attract customers and investors. Procurement plans are formulated and submitted to the department for tender listing and procurement one month before the target year.

5.3. Results Validation

Figure 6 shows the number of rooms sold out and the marketing segment for each month of 2020 following the COVID-19 situation. Before COVID-19 broke out (January and February of 2020), the average that the Evergreen hotel could reach was 1456 rooms (18.6% of the total of rooms). March to May of 2020 was the worst time of COVID-19 for hotels, with 825 rooms per month (12.8% of the total of rooms) booked by customers. From June to October of 2020, because of applying the new strategy for booking rooms, the percentage of orders increased dramatically, with 3107 rooms per month (40% of the total rooms). November and December of 2020 were two months that show a stable time after the improvement period of the hotel, with 2472 rooms per month reserved to customers. From this chart, it is observed that the rooms were sold out after using TRIZ innovation methodology and still increased following by month during 2020.

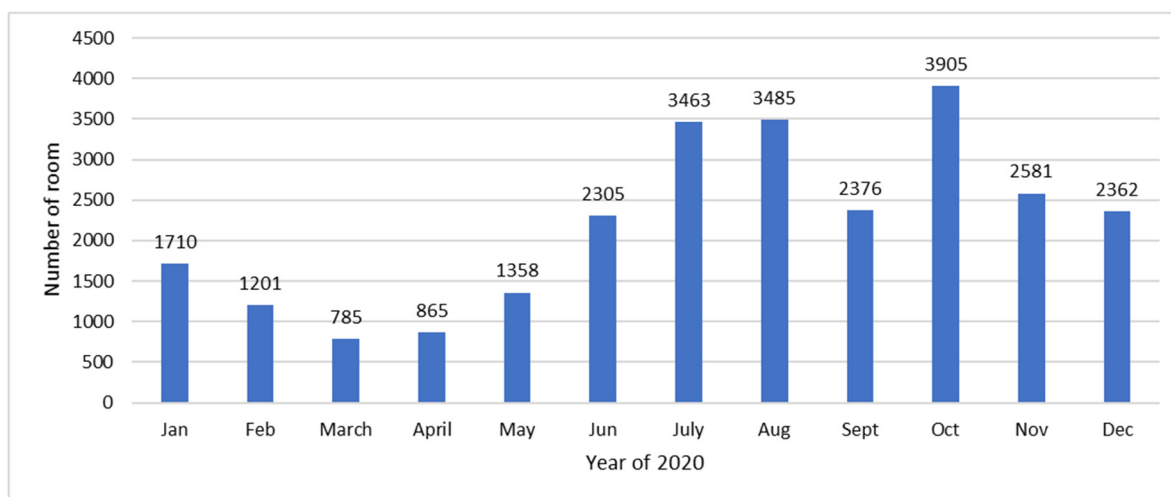


Figure 6. The number of rooms booked in 2020.

Figure 7 shows the situation for booking rooms following the year's quarters (2020). From the chart, although the hotel was affected by the COVID-19 situation, the Evergreen hotel recovered and even reached a better situation for 2021 with an increasing percentage covering four quarters. Before improving by applying TRIZ, the hotel reached 16% and 19% total of rooms from booking by customers; however, in Q3 and Q4, Evergreen reached 40% (more than 21% compared to Q1 and Q2). Therefore, Q4 was when hotels decided to stop using the discount for booking and used the new system to run hotels only; however, the percentage of sold-out rooms was 38% higher than before the COVID-19 situation, which means the new strategy is effective for hotels.

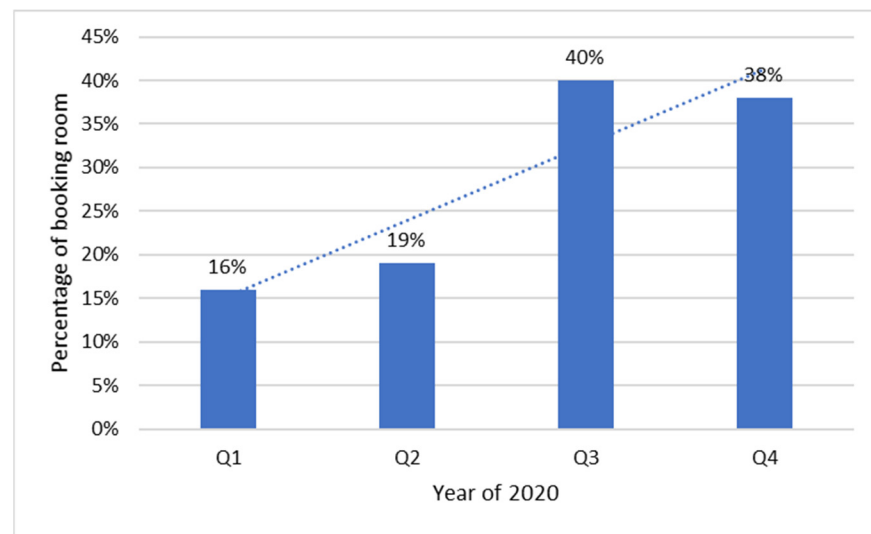


Figure 7. The booking rooms situation of hotel during four quarters in 2020.

Figure 8 shows the situation for booking rooms following the situation COVID-19 in 2020 for the Evergreen hotel. From the chart, before improving by applying TRIZ, the hotel reached 19% of total rooms from booking by customers (January and February of 2020). However, during COVID-19, the number of booked rooms of the hotel calculated and predicted by the marketing department was 13% (March to May of 2020). By realizing the bad situation could appear again in the next months in 2020, hotels decided to improve and change.

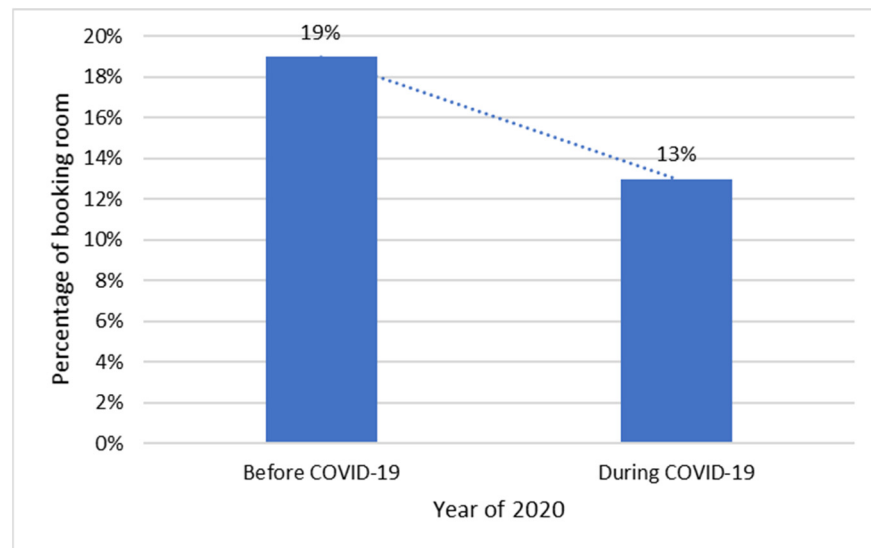


Figure 8. The predicted hotel's booking before and during COVID-19.

Figure 9 shows the percentage of employees of two companies, Evergreen and Taixie company, during and after COVID-19's emergence. With realization of the world's situation during COVID-19, combination and cooperation are the best solutions for the existing difficult time. From July until December of 2020, the percentage of employees of Taixie company made up approximately 40% to 55% depending on the situation of the disease in Taiwan.

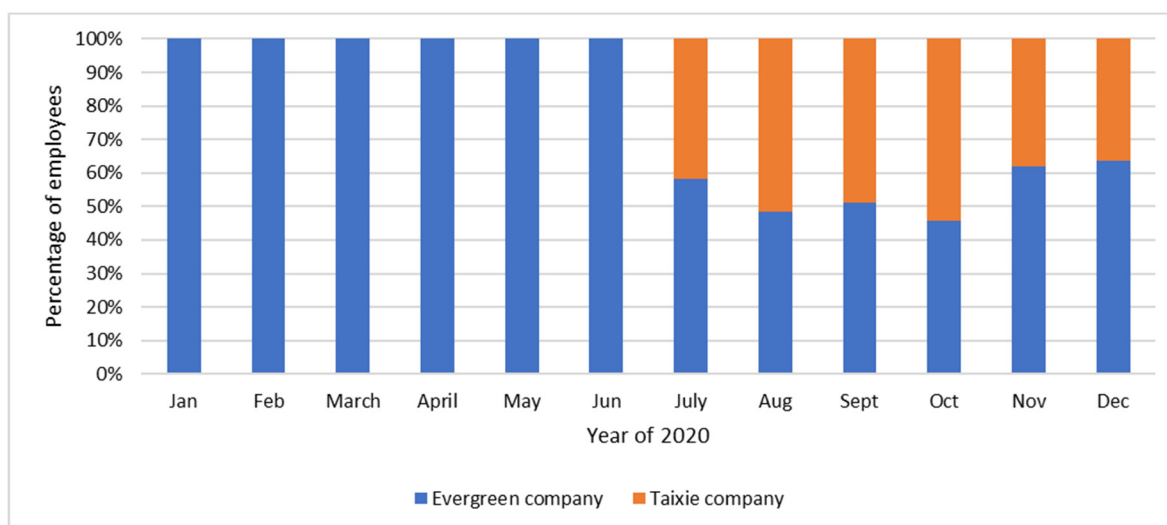


Figure 9. The percentage of employees of Evergreen and Taixie company in 2020.

Figure 10 shows the rate of hotels before and after the COVID-19 pandemic when applying the TRIZ method in the Evergreen hotel from the websites of Agoda.com and booking.com. The rating after improving is 8.5 scores higher than before, at 8.3 scores. From the chart, the effects of the hotel's new strategy were accepted by customers.

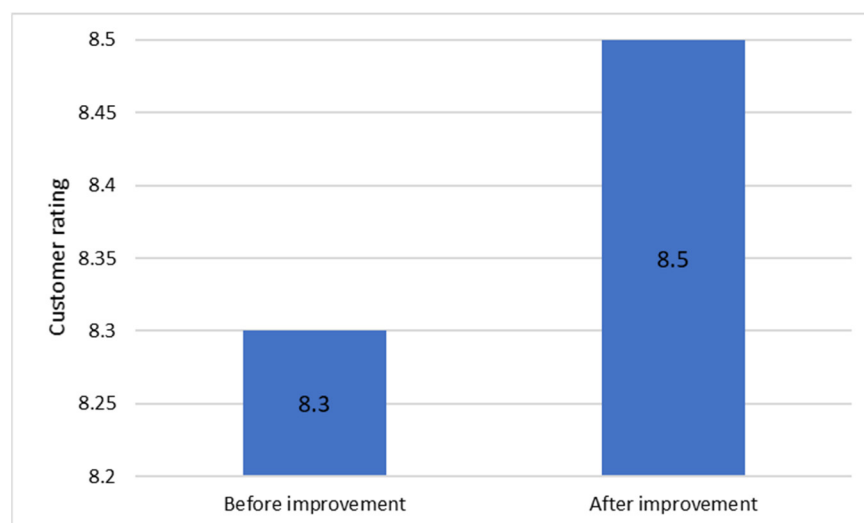


Figure 10. The rating of customers before and after improvement in 2020.

6. Discussion and Conclusions

The quantity of booking plays an important role in the net income of the Evergreen group's 10 hotels located in Taiwan. However, COVID-19, as an uncontrolled factor, made hotels need to change flexibly with the new strategy and control system in the booking system and elucidate the latest model to run business to cover the difficult time. During the early COVID-19 period, booking processes were often inefficient because of canceling and an unsafe hotel environment. Besides marketing problems, human resources in hotels were a difficult solution. The main purpose of the TRIZ methodology in this paper was to identify and fix the mistake in the system of hotels in the marketing and HR department. The analysis results can serve as a reference to execute, improve, and simplify operating processes, enhancing efficiency.

Regarding solving the tourism industry decision-making problem under the COVID-19 pandemic, according to the findings of [10], it was advised that the "quality management"

of the international travel “bubble zone” be prioritized as a decision-making criterion during the pandemic. Another article [46] aimed to improve the community’s psychological perspective to aid in the revival of the area’s tourist business. The community must be aware of the current situations and must be able to innovate to support their family from numerous online micro-retail company gaps. This paper proposed some innovative recovery strategies to assist the tourism industry in anticipating the impact of COVID-19 during the pandemic by implementing several business recovery strategies, such as recognizing lost tourism business basics, reviving the business and running it normally and effectively, understanding the changing cultural character of tourists and new business identities, and determining the business position. Based on the impact of the influencer market on consumers of the tourism industry, the study of [47] found that most of the participants are not influenced by social media influencers in terms of deciding where they would travel.

In our study, the results showed that the CCP efficiency was increased from 19% to 40% after applying the TRIZ solution, yielding an improvement rate of 21%. The customer rating was improved from a 8.3 to 8.4 score after conducting the improvement. Aside from that, changing the hotel structure with a partnership with the Taixie company assisted Evergreen in reducing various cost pressures to manage the business and recover after a difficult period. This improvement in efficiency is directly reflected in the categorization completion rate of planned and unplanned long-term acquisition projects, which are complex and contain extended turnaround periods. This paper can be a useful reference for managers, investors, governments, and policymakers to improve the sustainability performance in the tourism industry.

The contributions in this research can lead to new lines of inquiry in the hospitality area. Several further questions emerge in light of the discoveries presented in this paper. A few of the most prominent are listed. By applying the TRIZ method to the Evergreen hotel with good results, the researcher would like to uncover new research to maintain and improve the outcome after using the TRIZ method during the COVID-19 period. Because of unpredicted diseases in the future, the latest running model of hospitality continuously needs to be changed to fill the large gap. The newest trend in the field will focus on customers’ requirements in safety, size of rooms, and 3D experiments, mobile check-in services, robots in hotel and restaurant settings, etc. The research is a reference to guide other hotels in flexibly adapting to the hotel industry’s changing and difficult times.

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