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Investigating Efficiency and Innovation: An Exploratory and Predictive Analysis of Smart Airport Systems

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Abstract: By exploring the top three airports in Asia, this study explores the area of smart airport systems. With the goal of analyzing the significant elements of airport services that captivate travelers' attention through online reviews and establishing a correlation between sentiment in reviews and numerical ratings given by travelers, the study analyzes what captivates travelers' attention. Data mining, frequency analysis, sentiment analysis, and linear regression are employed in this study in order to analyze a dataset of 10,202 online reviews. The results indicate that the most common attributes of airport services significantly impact customer satisfaction, as well as how the sentiment expressed in online reviews correlates with the numerical ratings. A significant contribution of this study lies in its contribution to understanding the dynamics of customer satisfaction in the field of airport services as well as in identifying areas for improvement that could enhance the overall traveler experience in the burgeoning field of smart airports. In the context of smart airport systems, the analysis of exploratory and predictive data provides valuable insights into the optimization of airport operations, thus enriching the body of knowledge in this rapidly evolving area and providing the foundation for future research.

Keywords: smart airport; smart hospitality; predictive data analysis; sentiment analysis; top frequency

Citation: Williady, A.; Handani, N.D.; Kim, H.-S. Investigating Efficiency and Innovation: An Exploratory and Predictive Analysis of Smart Airport Systems. *Digital* **2024**, *4*, 599–612. https://doi.org/10.3390/digital4030030

Academic Editor: Costas Vassilakis

Received: 9 April 2024
Revised: 28 June 2024
Accepted: 2 July 2024
Published: 10 July 2024

1. Introduction

As one of the emerging sides of the hospitality industry, smart hospitality is becoming more and more attractive [1]. It is predicted that by 2031, smart hospitality is expected to command a market size of USD 133.7 billion worldwide [2]. Generally, "smart hospitality" refers to the use of technology and the IoT in the operation of hospitality establishments in order to enhance the experience of visitors and provide them with a convenient and enjoyable environment [3]. Moreover, new technologies and the internet of things appear to be reshaping the hospitality sector and facilitating the transition to a more intelligent industry [4].

Wireless infrastructure is likely to become the standard for future IT applications in the lodging industry, resulting in cost savings and improved efficiency, as well as improving customer relationship management (CRM) and property management [5]. As a result, the availability of information technology is now a core requirement of hospitality and tourism education, with some smaller colleges facing difficulties owing to the high costs of software [6]. Previous studies have noted that information technology has significantly improved profitability, productivity, and customer satisfaction in the hospitality and tourism industries [7].

A fundamental element of development in contemporary aviation has been the integration of technology into airport infrastructure and operations, which has led to significant improvements in efficiency, security, and passenger experience [8]. As evidenced by the escalating adoption rates of automated check-in kiosks, biometric screening, and advanced baggage handling systems, the usage of smart technology in airports is statistically evident. It is predicted that the usage of self-kiosks of any kind in airports will reach about 40% by 2024 [9].

Furthermore, it is projected that the global market for smart airports will grow exponentially, representing a compound annual growth rate of approximately 9% over the next decade [10]. In addition to improving operational capacity, these investments aim to enhance the passenger experience. It is clear that the adoption of these technologies marks the beginning of a transformational phase in airport management, emphasizing the crucial role that digital innovation will play in shaping the future of air travel. Global aviation demands are increasing for safety, speed, and service quality as airports use advanced technologies to harness the potential of advanced technologies. The trajectory of airport growth is aligned with the trajectory of the global airport and aviation industry.

In the travel and hospitality industry, these technologies can facilitate efficient resource management across a variety of subsectors (for example, transportation, accommodations, and events). Additionally, the development of information technologies has made it easier for people to share information on a global basis [11]. An example of technological advancement in the hospitality industry is smart mobile technology, which combines information aggregation, ubiquitous connectivity, and real-time synchronization [12].

This paper addresses the significant shifts in the hospitality industry resulting from the integration of technology. Specifically, it conducts an exploratory study focused on technology's impact on airports, with a particular emphasis on the top three airports in Asia. The study investigates key areas of airport operations that garner attention from visitors, as evidenced by online reviews. Its primary goal is to identify crucial attributes of airport services that attract travelers' interest, as reflected in these reviews. By analyzing the correlation between the sentiments expressed in the reviews and the numerical ratings assigned by travelers, the research sheds light on factors that captivate travelers. To achieve these objectives, the study employs text mining to extract insights from travelers' experiences shared in online reviews. Additionally, it uses regression analysis to identify the principal elements influencing traveler satisfaction. The research also explores the relationship between the sentiment expressed in online reviews and the corresponding numerical ratings provided by travelers. The novelty of conducting such research is that it is an approach to big data analysis on smart airports. Even though smart airport research has been conducted several times using various methodologies, this study specifically applied the big data approach to this specific industry to see the current trend and ongoing development of smart airport areas.

2. Literature Review

2.1. Smart Hospitality

The concept of smart hospitality is a revolutionary approach to the hospitality industry, which leverages technology to enhance guest experiences, improve operational efficiency, and drive sustainability. To achieve this, internet of things (IoT)-devices, artificial intelligence (AI), and data analytics are integrated in order to create a seamless and personalized guest experience [13]. Hotel and resort companies that adopt smart hospitality solutions are equipped with intelligent energy management systems, automated guest services, and personalized room environments. For instance, there are smart mirrors that tell daily weather information [14]. In addition to this, AI-driven chatbots and virtual concierges are becoming more prevalent, improving customer service and satisfaction by providing instant information and assistance.

There were eight major research streams identified in smart tourism research between 2008 and 2020, with most works focusing on smart ecosystems and technologies, highlighting the need for enriched knowledge in other streams and the COVID-19 response [15]. Previous studies have mentioned that it is possible to enhance the performance of revenue management and boost competitiveness in the hospitality industry through the integration of big data and interconnected applications in a smart hospitality ecosystem [16]. In addition, a study was conducted to develop a new framework of the ten technology competencies to be used by hospitality practitioners to cope with the smart era, highlighting the importance of technological proficiency in this field [17]. Hospitality and tourism professionals can take advantage of smart service experiences to offer personalized, proactive services, as well as empower customers, provide seamless experiences, enjoy the experience, protect their privacy, and ensure accurate service delivery [18]. The use of smart hospitality based on customer centricity, personalization, and marketing in networked destinations creates sustainable business ecosystems that benefit all parties involved [19]. In light of this discussion, it has been mentioned that smart tourism destination research helps to identify domains, journals, and themes that can be explored in the future, providing a guide for academics and professionals alike [20].

2.2. Smart Airport Systems

As one of the effects of the fourth industrial revolution, airport operations can be simplified by utilizing cutting-edge technology, and passenger experiences can be enhanced. In addition, the overall efficiency of airports can be improved [21]. With smart airports, it is possible to improve aviation security, passenger convenience, operational efficiency, and resource optimization, as well as address key challenges and research priorities in the future. Initially, the idea of a smart airport was proposed to provide basic information to customers in a simpler and more efficient manner without the need for face-to-face interaction [22].

Through the integration of certain technologies, such as the internet of things (IoT), artificial intelligence (AI), biometrics, and data analytics, airport functions are optimized, such as check-in, security, baggage handling, and aircraft maintenance [23]. As a result, passengers experience shorter waiting times, enhanced personalized service, and a smoother travel experience. Additionally, airport operators are able to improve security, manage resources more efficiently, and make more accurate, data-driven decisions as a result of these technologies.

In a previous study, the smart airport was defined as a facility that enhances infrastructure intelligence and evolves into a smart facility to support growth and to provide an enjoyable travel experience through the integration of the industrial IoT and smart devices [24]. Another study also defined a smart airport as a part of a smart city, being a sub-system of a big smart city. Smart airports play a role in connecting urban life and aircraft movements [25]. It was also mentioned in a previous study that an IoT-based smart airport solution would improve passenger services, operational efficiencies, and security capabilities, resulting in a more robust, safe, and secure airport experience [26]. In relation to smart airport management systems, it has been noted that the IoT could improve passenger processing and flight management, enhancing airport services and facilitating passenger journeys [27].

In order to improve passenger convenience and productivity, the smart airport service framework divides airport processes into three categories: u-fast passenger, u-guidance, and mobile services [28]. A recent example is Changi airport's smart airport framework, which combines data analytics, robotics, artificial intelligence, and the IoT to enhance customer experience and enhance operational efficiency while balancing technological advances and the needs of customers [29]. Similarly, smart airports in Saudi Arabia can enhance the passenger experience by automating border controls, handling baggage, and improving terminal navigation as a result of the internet of things [30].

Smart airports are not limited to using advanced technologies to enhance customer service. As part of sustainable tourism, UK airports are implementing green practices such as on-site wind turbines, biomass plants, intelligent heating and lighting systems, rainwater harvesting, improved recycling facilities, and financial incentives for alternative forms of transportation [31].

As mentioned above, there are many technological advancements adopted in smart airport services. Many studies have been conducted to better understand technology acceptance in many areas, including the hospitality sector [32]. In terms of smart airports, this study will also take a look at technology acceptance in airports from a theory point of view, such as through the technology acceptance model (TAM). This model consists of perceived ease of use and perceived usefulness variables [33]. These two items define how easy it is to use a technology (PEOU) and how useful the technology will be for them (PU) [34].

2.3. Customer Satisfaction

The concept of customer satisfaction has many interpretations, with a common interpretation reflecting a feeling derived from evaluating what was received compared to what was expected, the purchase decision, as well as the fulfillment of the customer's needs [35]. The enjoyment that vacationers want or anticipate from the goods, services, and locations they experience is known as satisfaction [36]. Customers must be satisfied in the hospitality industry to ensure loyalty, reputation, and continued business [37]. In another study, customer satisfaction was defined as an assessment of the quality of consumer service based on one or more interactions with the company's customer service employees, which was found to contribute to the profitability, loyalty, and success of the company [38].

In the hospitality industry itself, customer satisfaction refers to how customers perceive value, quality, and service, influenced by factors such as location, service, and industry [39]. In addition to the quality of service, amenities, and the personalization of the stay, customer service encompasses every aspect of the guest experience, from the initial booking process to the final departure [40]. Nowadays, customers have higher expectations than ever before, not only in terms of comfort and cleanliness but also in terms of a unique experience, convenience, and rapid service [41]. By embracing technology to streamline processes and enhance guest interaction, hospitality businesses can meet these demands. It is critical to personalize the service, understand the preferences of the guests, and address issues as soon as they arise.

There are not many specific studies on smart hotels yet. However, few studies have covered various points of view. Based on a previous study, passenger satisfaction at airports can be improved by paying attention to staff helpfulness, airport appearance, signposting, toilets, and bus connections, and reducing the impact of insignificant service issues [42]. Another previous study also mentioned that the analysis of customer sentiment on airport websites can provide valuable feedback on customer satisfaction and help to improve airport services [43].

It is common for airports around the world to compete for higher ratings in order to satisfy their visitors. As an example, UAE airports can improve customer satisfaction by implementing a framework for assessing their customer service operations [44]. There is currently an improvement in the airport taxicab services in the United States through the modification of the processes from a hierarchical to a network approach, which has resulted in an increase in customer satisfaction and improved the management of increased passenger volumes [45]. Another study was conducted, which focused on the satisfaction of airport visitors, and it was found that a strategic and holistic approach to customer service and branding was proven to substantially increase customer satisfaction and, in turn, lead to increased revenues [46].

The integration of advanced data analytics into understanding customer feedback has become increasingly important. By analyzing online reviews and feedback, companies

can gain insights into customer satisfaction and identify areas for improvement. This has led to a growing interest in exploring the relationship between the sentiment expressed in customer reviews and their corresponding numerical ratings.

Recent studies have shown that there is a significant correlation between the sentiment of online reviews and the numerical ratings provided by customers. For instance, AlMansour et al. suggested that rating scores might not always reflect the sentiment expressed in the associated review texts [47]. Similarly, Nazar and Bhattasali focused on the sentiment analysis of customer reviews from Amazon and developed a machine-learning model to classify reviews as positive or negative [48]. Cuizon and Agravante's work on a web-based travel journal application demonstrated high accuracy in predicting numerical ratings based on sentiment analysis [49].

Building on these findings, this study aims to validate the relationship between review sentiment scores and numerical review ratings within the context of the airport industry. By examining the correlation between travelers' sentiments in reviews and their numerical ratings, this research seeks to offer valuable insights specific to airport customer experiences.

Based on the literature reviewed, we propose the following hypothesis:

H1: there is a significant relationship between review sentiment scores and numerical review ratings, indicating that positive or negative sentiments in reviews align with the numerical ratings provided by customers.

3. Methodology and Results

3.1. Research Framework

This research is based on an exploratory study of the online reviews of the top three airports in Asia based on Skytrax ratings. The three airports were Singapore Changi International Airport, Haneda Airport in Japan, and Incheon International Airport in South Korea [49]. It has been mentioned that these three airports are now utilizing smart technology to create a more seamless process [50]. It was also mentioned that smart technology is an important part of security standards [51].

This paper describes the use of exploratory techniques in studying the social interactions and dynamics of smart airports. Exploratory research has been known to be used to develop measurement tools that reflect reality [52]. In other industries, such as the health industry, exploratory studies are known to be a way to develop hypotheses for further study [53]. This study utilized online reviews to conduct an exploratory study regarding customer satisfaction in airports.

The collected online reviews were from 2017, as the development of technology in airports generally started in 2017. With a total of 10,202 online reviews from the three airports, we first collected the data through Out Scraper, an online API data mining software. The data collected included online review texts in English, numerical review ratings, and more information, such as username, time of review upload, and pictures. After receiving the data, the review was pre-processed by creating stop words to have a more meaningful result.

The first analysis was the frequency analysis. During this analysis, the top words that appeared often in online reviews were identified. Using a KH coder and word cloud generator, the top 100 words in this study were visualized, followed by the sentiment analysis. The sentiment analysis showed the polarity of the review text, such as positive, negative, and neutral. This study utilized Azure machine learning to receive the sentiment score. The sentiment score generated using Azure Machine Learning showed scores from 0 to 1; scores below 0.45 were categorized as negative, 0.45–0.59 were neutral, and 0.60–1.00 were positive. With these sentiment results, we created a visualization of which words frequently appeared in each positive, negative, and neutral review. Lastly, a predictive analysis was conducted through linear regression analysis to understand the

relationship between the review sentiment and the review rating. The visualization of the research framework can be found in Figure 1.

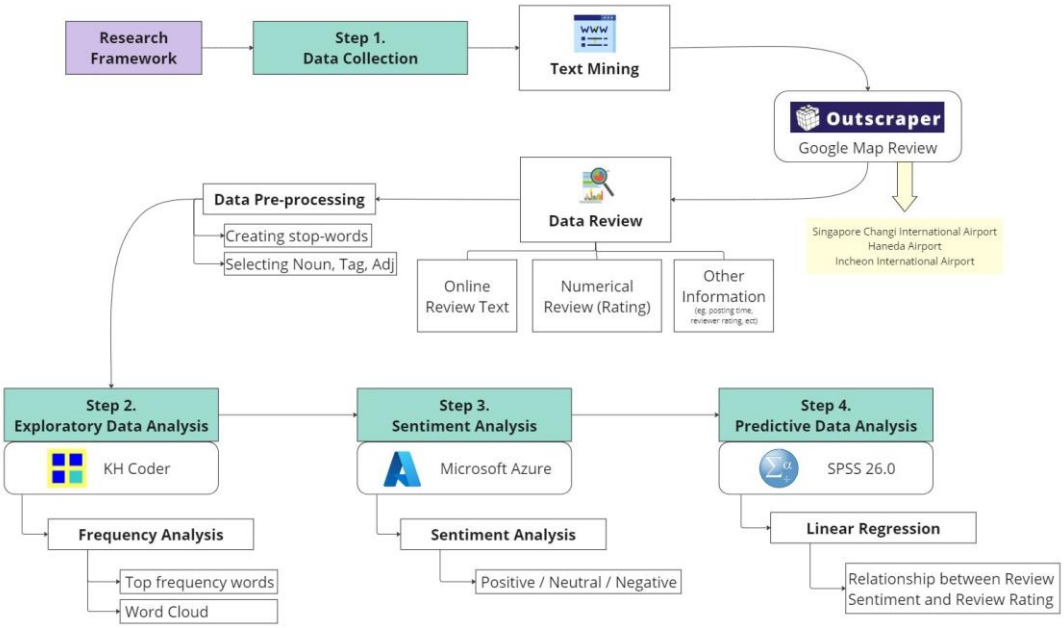

Figure 1. Research framework.

3.2. Exploratory Analysis

The exploratory analysis was conducted using KH Coder software to obtain the top-frequency words. The 100 top-frequency words are shown in Table 1. Words such as airport, time, world, place, and terminal are in the top five, with frequency exceeding 900 times. This means that these words were mentioned more than 900 times in 10,000 reviews. Words such as technology, robot, interact, and machine appeared with a frequency of as much as 300–200. This shows that the technology and IoT facilities in airports are slowly appearing and being mentioned in online reviews.

Table 1. Top 100 most frequently used words.

Words	Frequency	Words	Frequency	Words	Frequency	Words	Frequency
Airport	5595	Robot	323	Custom	202	Bag	127
Time	1538	Interact	309	Night	196	Class	127
World	985	Departure	305	Trip	182	Point	125
Place	983	Store	305	Layover	179	Everyone	121
Terminal	920	Option	304	Travel	177	Something	116
Shop	898	Check	301	Fun	171	Transfer	115
Flight	897	Luggage	286	Access	166	View	114
Staff	793	Everything	276	Traveler	157	Hotel	113
People	699	City	270	Water	152	Card	111
Food	646	Souvenir	268	Airline	149	Observation	111
Service	549	Year	267	Morning	149	Sign	110
Security	530	Airplane	266	Process	147	Station	110
Experience	521	Country	258	Space	146	Tourist	110
Area	506	Plane	256	Information	144	Jewel	109
Restaurant	499	Toilet	249	Parking	144	Mall	109
Hour	479	Garden	238	Customer	142	Price	109

Gate	462	Line	236	Plenty	141	Transportation	108
Facility	456	Train	230	Center	136	Air	107
System	403	Way	230	Queue	136	Destination	107
Shopping	387	Number	228	Counter	135	Business	104
Technology	372	Floor	225	Deck	134	Tour	102
Lounge	368	Arrival	218	Attraction	132	Butterfly	100
Bus	353	Machine	214	Passport	131	Meal	100
Immigration	329	Waterfall	213	Room	130	Board	98
Day	323	Minute	205	Amenity	128	Nothing	98

The top 100 words were taken and made into a word cloud for easier visualization. The bigger the words, the more frequency they have. The word cloud can be seen in Figure 2. In this word cloud, we can clearly see words such as "airport", "world", "time", and "terminal".

Figure 2. Word cloud. (generated by: wordclouds.com)

3.3. Sentiment Analysis

One of the interesting study areas for online reviews is sentiment analysis. Sentiment analysis was used to uncover and highlight the enhancement and research using text mining [54]. Text mining techniques were then used for data pre-processing [55]. The tone of the review was considered in this research. This study utilized Azure machine learning to obtain the sentiment score, and we continued the analysis with the provided score. Sentiment analysis was used to assess user comments and make judgments about their opinions [56]. The study also explored sentiment analysis techniques using machine-learning classifiers and deep-learning models [4]. Additionally, the accuracy of the Azure Sentiment Analysis service for different languages and text lengths was analyzed [57]. The study compared the traditional dictionary-based approach with machine learning for sentiment analysis.

First of all, the co-occurrence analysis based on sentiment was conducted. Words that often appeared in the positive, negative, and neutral groups are visualized in Figure 3. This approach allowed for the identification of word groupings with meaningful narratives and their corresponding sentiment scores.

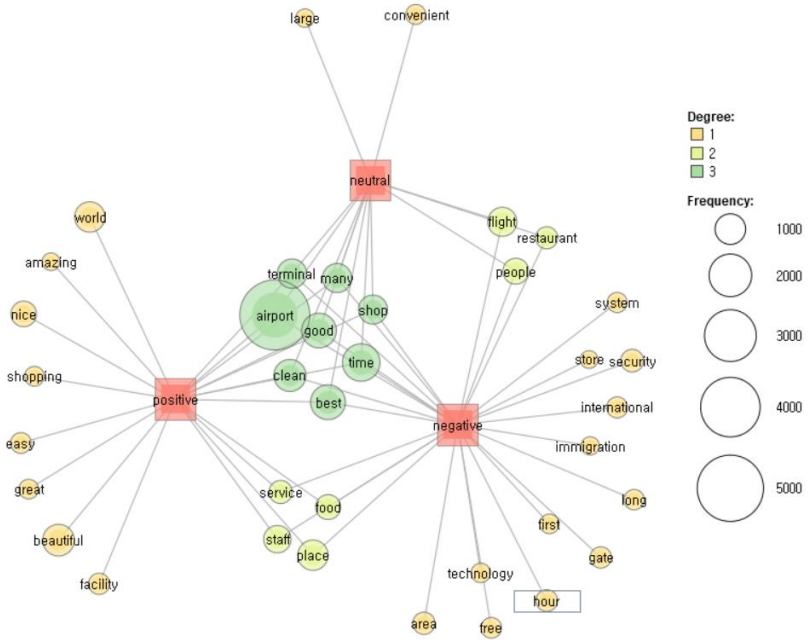

Figure 3. Co-occurrence analysis of sentiment polarity.

In the co-occurrence visualization of the sentiment group itself, words such as "easy" and "great" appeared on the positive side of the cluster, which means that the review was in line with the TAM, which meant the technology in smart airports is easy to use and creates a positive attitude towards their satisfaction of the smart airport. On the other hand, in the neutral cluster, there is the word "convenient", which means that people who used smart airport technology felt the process in the airport was convenient. However, no words were used to describe the usefulness of the TAM in this co-occurrence analysis result.

After the co-occurrence visualization of the sentiment groups, a predictive analysis was conducted. This study shows that distinctive words were frequently mentioned in the positive, negative, and neutral groups. Table 2 shows the summary of the descriptive information on sentiment polarity.

Table 2. Descriptive information on the sentiment analysis

Number	Standard Score	Sentiment Group	Frequency	Percentage
1	<0.45	Negative	2,764	27%
2	0.45–0.59	Neutral	1,047	10.5%
3	≥0.60	Positive	6,391	62.5%
	Total		10,229	100%

3.4. Predictive Data Analysis

One key piece of data collected from mining the online reviews was the numerical rating accompanying each review. Previous studies have explored the relationship between the sentiment expressed in each online review and its numerical rating [58]. This study aims to validate the findings of these previous studies within the context of the airport industry. By examining the correlation between travelers' sentiments in reviews and their numerical ratings, this research seeks to offer valuable insights specific to the realm of airport customer experiences.

In this study, the independent variable is the review sentiment score obtained using Azure Machine Learning, and the dependent variable is the numerical review rating derived from the initial text mining process.

There is a hypothesis that examines the relationship between the review sentiment scores and numerical review ratings to determine if positive or negative reviews align with the ratings provided by customers. Several studies have explored this relationship. AlMansour et al. suggested that rating scores may not always reflect the sentiment expressed in the associated review texts [47]. Nazar and Bhattasali focused on the sentiment analysis of customer reviews from Amazon and aimed to build a machine-learning model to classify reviews as positive or negative [3,48]. Cuizon and Agravante presented a sentiment analysis approach to predict the numerical ratings of text reviews in a web-based travel journal application, achieving an overall rating prediction accuracy of 82% [4,49].

By applying similar methodologies, this study examines whether the sentiment expressed in the customer reviews of airport services correlates with the numerical ratings. Specifically, we performed a linear regression analysis to determine the predictive power of the sentiment scores on the numerical ratings.

To provide a visualization of the numerical review data mined from the online reviews, we present some examples in Table 3. These data points were used to conduct the linear regression analysis and evaluate the hypothesis 1 which is visualize in Figure 4.

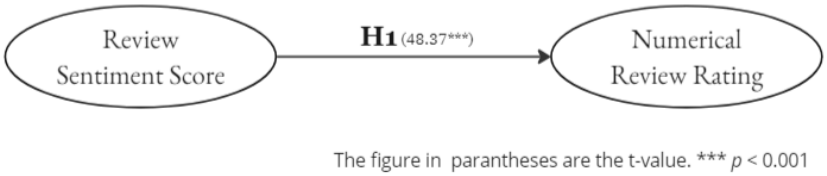

Figure 4. Hypothesis 1.

Table 3. Text and numerical review rating examples.

Number	Review Text	Rating	Sentiment Score
1	The staff was not courteous, the flight was late, there was no water, and it was chaotic	3	0.278
2	I had a very bad experience at this airport. I arrived here; immigration stopped me with a 4 hours wait	2	0.010
3	It is a hit-and-miss when it comes to their English-speaking abilities, but you will receive what you need from them	5	0.904

After the linear regression was conducted, the R^2 value showed that 18.6% of the numerical ratings could be explained by the sentiment value. Numerous factors can impact customer satisfaction, yet due to their infrequent occurrence in the gathered data, they were not encompassed in the five identified clusters, resulting in relatively weak correlations between the independent and dependent variables. This situation arises from the multitude of elements influencing customer satisfaction. It is challenging to include all pertinent factors in the analysis of the output variables from text mining data, like customer opinions. As indicated in earlier research, this complexity often leads to a lower R^2 value [36,58].

As a result, the number of positive reviews made up the majority of the data, which was more than 60% of the total reviews collected in this research. In the regression analysis, we found that the value of the *t* statistic for the slope was 48.37. Thus, we found

support for the linear relationship between the score and review numerical rating. A summary of the regression analysis results is shown in Tables 4–6.

Table 4. Regression analysis result 1.

Regression Statistic for a Smart Airport	
R square	0.186
Standard error (SE)	0.991

Table 5. Regression analysis result 2.

	Df	SS	MS	F	Significance
Regression	1	2298	2298.3	2339.321	<0.001
Residual	10,227	10,047	0.982		
Total	10,228	12,345			

Notes: Df: degree of freedom; SS: sum of squares; MS: mean square.

Table 6. Regression analysis result 3.

	Coefficient	Standard Error	*t*-Value	*p*-Value
Constant	3.37	0.02	148.77	<0.001
Mean	1.68	0.03	48.37	<0.001

4. Discussion of the Study

This study serves as an initial exploratory analysis of the smart technology and systems in airports in Asia. This study utilized a big data approach that is emerging in industry research. Research on various specific hospitality using big data is varied, such as studies on coffee shop comparisons [59] and the cruise industry [60]. Many studies have utilized big data to understand trends in hotels [61,62] and restaurants [63].

The exploratory analysis showed that words such as airport, time, and world have a high connection with airports, which is a result that is similar to a previous study [64]. However, words such as robot, interact, and technology were in the range of the top 50 words, which shows that people are starting to take notice of the new integrated technology; these include reviews such as "The airport has buses to get all around Korea. And there are robots!" and "Large airport equipment advanced technology dynamic line planning smooth and comfortable standby environment". These reviews show that the integrated technology in airports is changing the experience people have when visiting airports. The first review also shows a sense of excitement that might need to be further explored. Without ignoring the top words, words such as service, security, and experience were still at the top frequency, which shows that the hospitality industry will always be connected with service and experience due to the nature of the industry, which is the service industry [65].

The theoretical approach of this study showed that there were words such as "easy" and "convenient" that are related to one of the TAM variables, which is perceived ease of use (PEOU). However, there were no words related to the perceived usefulness or the usefulness of the technology in airports for the customer. With this, highlighting how useful the technology can be for visiting customers is one of the marketing approaches to campaign about technology usage in airports.

The sentiment analysis in this study showed that words such as "amazing", "great", and "easy" were highly positive. These words are positive adjectives that are used to describe the conditions and experiences people have when visiting an airport; these include reviews such as "Amazing cleanliness and great memories" and "Nice and clean support with easy-to-follow signs and instruction". The majority of the reviews were positive reviews, which shows that the visitors were happy with the airport's overall facilities and experience overall.

As for the predictive data analysis, there was a significantly positive relationship between the review sentiment score and the numerical review rating (Table 7). The linear regression results show a linear relationship. To prove the statistical analysis, here, we provide examples of the numerical rating and sentiment value being linear. When the numerical rating review is low, it is noted as a low sentiment score, which means it is a negative tone review.

Table 7. Comparison of the numerical ratings and sentiment polarity scores.

Review	Numerical Rating	Sentiment Value	Sentiment Score
Been waiting for more than 30 min after the expected time of arrival	1	Negative	0.372
It was a lonely Haneda for midnight flights	3	Neutral	0.451
Food left much to be desired, and customs was a super far walk	3	Neutral	0.452
I came after a long time	4	Positive	0.616
The night view from Haneda is recommended!	4	Positive	0.731
It is clean and all the grand staff are kind	5	Positive	0.809

5. Implications and Suggestions for Future Studies

There are several implications for this study, both theoretically and managerially. First and foremost, this study contributes to the basic concept research towards smart airports. The first analysis of this study shows the important things that are considered by visitors, and this serves as a base for future studies when the perspective of airport visitors is needed. Secondly, this study also assists the understanding of online review sentiment polarity and its relationship with numerical ratings. This study, similar to previous studies, shows that when the review is negative, people will tend to provide low numerical ratings [66]. Previous studies have also mentioned that sentiment significantly influences customer satisfaction [65]. This was also shown in the results of this study.

From a managerial point of view, it is possible to see that the top 100 words are the things that visitors pay attention to. Therefore, airport managers and stakeholders should focus on those things more to gain a competitive advantage. If the airport stakeholders are trying to showcase their airport as a technology-based airport, this study shows that technology in airports is slowly emerging, and the promotion or familiarization of technology in airports should continue.

This study took the top three airports in Asia based on Skytrax, which does not represent all the airports in the world. Every continent and area has its specialty and focus area for where the airport wants to improve. For future studies, this should be considered as well. Future studies should also continue conducting time-series research to see the development of technology in smart airports. Another thing that future studies can consider is integrating another research method such as a survey to understand the technology acceptance of airport visitors.

Author Contributions: Conceptualization, A.W. and N.D.H.; methodology, A.W. and N.D.H.; software, A.W.; investigation, A.W.; data curation, A.W.; writing—original draft preparation, A.W. and N.D.H.; writing—review and editing, A.W., N.D.H. and H.-S.K.; supervision, H.-S.K.; funding acquisition, H.-S.K. All authors have read and agreed to the published version of the manuscript.

Funding: This research was financially supported by the Ministry of Trade, Industry, and Energy, Korea, under the "World Class Plus Program (R&D, P0020673)" supervised by the Korea Institute for Advancement of Technology (KIAT).

Data Availability Statement: The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

Conflicts of Interest: There are no conflicts of interest.

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