Identification of Airport Service Quality using Sentiment Analysis at Soekarno-Hatta International Airport

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Article Information	Abstract
	PT Angkasa Pura II is a state-owned corporation that operates airport services in Indonesia. The increasing number of passengers at Soekarno-Hatta International Airport presents challenges in managing significant traffic growth, which impacts infrastructure and services. Successfully addressing these challenges relies on technological innovation and strategies to enhance service quality with improving passenger satisfaction is crucial as traffic continues to rise. This study aims to assist PT Angkasa Pura II by identifying the most essential features of passengers' experience based on Airport Service Quality (ASQ) from Airport Council International (ACI) components using Google Maps reviews. This paper also compares the ASQ indicated in the social media reviews to the structure-based questionnaire responses from passengers at the airport in 2023. Based on the sentiment analysis of 17,481 reviews, the study discovers that airport facilities and environment are the most frequently mentioned ASQ aspects of Soekarno-Hatta International Airport. This result demonstrates that PT Angkasa Pura II should mainly focus on these two factors to enhance passengers' experience and activities at the airport. This research also finds that structure-based surveys might not provide the same data as ASQ produced from sentiment analysis on social media channels. In addition to several factors that contribute to this fact, the usage of social media data has shown to be a way to diversify survey methodologies to gather more complete customer insights.

A. Introduction

PT Angkasa Pura II is a state-owned enterprise that manages airport services in the western Indonesia. Currently, PT Angkasa Pura II manages 20 airports in Indonesia and has a vision to become the best-connected airport in the region [1]. The airport with the highest passenger traffic for PT Angkasa Pura II is Soekarno-Hatta International Airport. According to the Statistics Indonesia 2024 [2], the airport recorded 7,945,377 domestic passengers and 612,230 international passengers in 2021. By 2023, these figures surged to 18,538,674 domestic passengers, representing an increase of approximately 133%, and 6,783,267 international passengers, reflecting an 11% rise. The increase in passenger numbers at Soekarno-Hatta International Airport poses challenges that must be addressed. In addition to serving as a location for aircraft takeoffs and landings, the airport must now manage significant growth in passenger traffic, which can impact its infrastructure and services. Successfully addressing these challenges heavily relies on technological innovations and the development of strategies to enhance service quality. Therefore, improving passenger satisfaction will become increasingly important as passenger numbers continue to rise at Soekarno-Hatta International Airport and other airports managed by PT Angkasa Pura II in the coming years [3] [4].

Airport Service Quality (ASQ) from Airport Council International (ACI) is the primary indicator used by PT Angkasa Pura II to measure passenger satisfaction with airport services. ASQ measures end-to-end passenger service at airports, such as departure, retail or shopping, and arrival [5]. ACI develops this measurement to evaluate airport experience on all passenger touch points, consisting of pre-journey, departure, arrival, and post-journey stages. Arrival at airport, check-in, security/border control at departure, boarding gate, return flight, arrival at the destination airport, security control upon arrival, baggage claim, and passenger's return home are the elements of the process [6]. ACI asserts that ASQ is the optimal method for increasing customer satisfaction and non-aeronautical income. Fernandes and Pacheco have also studied that service quality at all touchpoints determines the commercialization methods adopted by airports [7].

ASQ also has been addressed by various publications. A study confirms that overall airport service quality is significantly related to passengers' behavioural intentions on airport and destination choice [7]. The other study investigates the impact of airport service quality on travellers' inclinations to return during the COVID-19 epidemic and its relationship to the destination of choice [8]. Publications on Airport Quality Service also progress steadily in the current years. Furthermore, there are more studies on ASQ in year 2020 than in 2017, 2018, and 2019 combined [9].

Nowadays, with the proliferation of digital data and user-generated content across the internet. People frequently use this medium to express their preferences and opinions towards certain services and share their experiences. This creates new chances for doing research by extracting significant data from social network platforms and then transforming the acquired data into useful information, such as doing data modelling on ASQ [8]. Multiple papers have also attempted to conduct research by examining user-generated material from the lens of ASQ. There is a study that intends to find service enhancements and

possibilities by doing topic modelling and sentiment analysis on data collected from the top 10 airports by Skytrax [10]. Another work utilizes a data-driven crowdsourcing strategy to investigate ASQ during the COVID-19 epidemic by analyzing Google Maps reviews from the 98 major airports in the United States. The work also constructs various taxonomies containing terms about ASQ qualities and uses sentiment analysis techniques to determine the sentiments of passengers [11] [12].

However, there are still only a few papers discussing ASQ in Indonesian airports, especially using social media analysis or data mining methods. Adding to this, the current sampling methodology of a structure based ASQ survey in PT Angkasa Pura II is also considered time-consuming, costly, and restricted in duration. This research aims to assist PT Angkasa Pura II by examining the most frequently mentioned ACI ASQ indicators of Soekarno-Hatta International Airport on social media and the sentiment toward these factors. These results are anticipated to serve as one of the underpinnings for PT Angkasa Pura II's business optimization efforts. It will also contribute to the research world by comparing the ACI ASQ qualities mentioned in the social media reviews to the results of the organization's quarterly manual surveys

B. LITERATURE REVIEW

Annually, PT Angkasa Pura II utilizes structured questionnaires to conduct ASQ surveys to passengers. Every quarter, this questionnaire is presented to prospective airline passengers at the airport over the course of two to three days. ASQ evaluation utilizing a standard questionnaire system, conducted by distributing a paper-based questionnaire and allowing respondents to rate each parameter on the questionnaire. These results have significant flaws, including a small sample size and minimal questionnaire-generated data [13].

Meanwhile, the explosion of the internet has driven an explosion of user-generated content. Consumers are accessing social media services from various digital devices (e.g, smartphones, notebooks and tablets) to download applications or through web-based applications. Individuals, communities, and organizations may exchange, co-create, discuss, engage in, and edit online user-generated or self-curated material via these highly interactive platforms [14]. Increasing numbers of studies acknowledge that passengers' online comments are a great source of data that may contribute to the study of passengers' experiences. Therefore, recent research has documented the impact of internet user-generated content. Social media channels such as Twitter, Skytrax review website, and Google Maps reviews have been the sources to obtain thoughts or issues from a vast, relatively receptive, and often rapidly evolving group of travellers [9] [13] [15].

Google Maps is a web-based mapping tool and platform provided by Google. It provides satellite images, aerial photography, street maps, 360° interactive panoramic views of streets, real-time traffic conditions, and route planning for foot, automobile, bicycle, air, and public transit trips. Reviews on Google Maps have been increasing exponentially since 2015. In addition, this sort of review allows visitors to develop thoughts with greater flexibility and without limits that might lead to psychological bias, a potential shortcoming of evaluation on structure-based questionnaires. Meanwhile, the star-based reviews that frequently appear in

Google online evaluations enable users to express their opinion of the location in a straightforward manner [10] [28]. Therefore, this publication uses data from Google maps customer reviews for Soekarno-Hatta Airport because people can freely submit their thoughts, experiences, or comments about sites or locations and the reviews are typically tied to customer experiences about a place [11]. In addition, more than 86,000 reviews are available for Soekarno Hatta Airport; this amount of data is already accessible and proves that a comprehensive dataset is available for study in this publication

Airport Service Quality

Airport service industry is a constantly changing business environment. Due to this complexity, customer satisfactory measurement can be a challenge [16]. Airport service quality is a tool for airport service provider to understand customer's feedback and level of satisfaction. It is used to investigate customer perceptions of overall airport services (Liou et al., 2011) [17]. It was developed by the Airport Council International to evaluate measures end-to-end passenger service at airports, consisting of pre-journey, departure, arrival and post-journey stages. It consists of a set of indicators that could help determine the level of customer's satisfaction in comparison to their expectation, such as "comfort, processing time, convenience, courtesy of staff, information visibility and security" [18] [19].

A popular approach to measure airport service quality is collecting customers review through traditional structured questionnaires [13]. The design is usually based on experts' opinion and/or previous research. Armenti et al. (2018) developed The Perceived Airport Service Quality Questionnaire (PASQQ) based on a systematic literature review and a qualitative pilot study. The pilot study used a mixed of data collection method and a multilevel analysis of internal airport documents, transcriptions of semistructured interviews with related personnel, field notes, and structured observations at specific airports [20]. However, this method has invited critics. Martin-Domingo et al. argues that questionnaires are more costly, not only financially, but also regarding private data confidentiality and customers' comfort [13].

With the emerging internet penetration across the globe, people are frequently used social media platform to express their preferences, opinion, and experiences, towards certain services. As a user-generated content platform, a large amount of information is now available on social media. Customers who went online and shared their opinions can help the service provider to understand consumer preference and demand [21] [22]. This opened a new opportunity to do airport service quality measures by using data from digital platform.

From several studies on ASQ, it is feasible to obtain diverse viewpoints for performing subject classifications that are tailored to the discussions and research questions. There is research that attempts to investigate the net effect of the eight airport service attributes on passenger satisfaction. The attributes are queueing times, terminal cleanliness, terminal seating, terminal signs, food & beverages, airport shopping, airport Wi-Fi connectivity, Airport Staff [31]. There is also research categorizing 34 attributes of ASQ into 108 words classified based on twitter attribute names derived from the comments. The selection of primary

keywords is based on the frequency of the keyword appearance on the data set and its associated definition with the ASQ [13].

The similar is process is applied in research to identify change of ASQ aspect in the context of Covid 19 on 98 busiest US Airports. On this paper, word collection was conducted based on manual screening on around 200,000 reviews to find words with highest occurrence on the dataset. Based on investigations of these studies, we find that even though these papers research different topics and unique research questions, the selection of ASQ attributes already acknowledges eight first-level topics defined by ACI, which are access, check-in, passport/personal ID control, security, finding your way, airport facilities, arrivals services and airport environment [10] [32].

Sentiment Analysis

Airport It is predicted that Indonesia will continue to see an increase in internet users. According to Nurhayati (2021) [23], the number of internet users in Indonesia in 2020 was estimated to be at 191 million. By 2025, this figure is projected to grow to almost 240 million. The country had around 70 percent online penetration in July 2021. With the exponential growth of internet, online communities, societies, and forums may feature various comments, feedback, or criticism [24]. Therefore, it is essential for the airport service industry to consider such internet reviews when attempting to measure airport service quality.

Sentiment analysis is an approach to measure customers satisfaction from user-generated content, such as website, blogs or social media. It focuses on the emotional polarity of consumers (positive and negative), as well as their attitude towards a certain issue [24] [25]. This technique offers the capacity to extract trends and information from textual data, giving an overview of the customer satisfaction levels and allowing the development of product quality improvement [26]. It categorises opinions in a sentence into positive or negative classification [27].

Various studies use sentiment analysis to measure airport service quality as a substitute or complementary to the conventional questionnaire or focus group discussion method. Gitto and Mancuso [24] study on "Improving airport services using sentiment analysis of the websites" shows that digitally available data, such as blog reviews, could address customer satisfaction better. The Martin-Domingo et al. [13] study used sentiment-analysis techniques to assess airport service quality at London Heathrow using user-generated data gathered from Twitter. This study demonstrates how sentiment analysis from Twitter enables new findings that are typically not seen in other approaches to measure the airport service quality. The paper makes the case that sentiment analysis could complement more conventional methods like literature reviews or expert focus groups to develop new indicators for airport service quality. However, they argue that the sentiment analysis approach needs to be rigorously assessed before completely replacing the more established approach of measuring airport service quality. Dhini and Kusumaningrum [27] study on "Sentiment Analysis of Airport Customer Reviews" examined the user-generated content from Google Review can show the priority for improvement of airport management. Munawir et. al [28] study gathered

reviews data from Google Maps to understand the public perceptions of thematic parks in Bandung, West Java, Indonesia.

For this study, the sentiment analysis will be performed on filtered Google Maps reviews using Text2Data, a simple and effective tool for data filtering and sentiment analysis that has been utilized in several studies and publications [29] [30]. In addition to sentiment analysis, this tool also provides the services to do text summarization, document categorization, entity extraction, themes discovery, keyword analysis, citation detection and slang detection.

Text2Data employs machine learning to allow users to examine text according to its content through scaled or REST API Services. It combines techniques for sentiment analysis, such as keyword search, lexical affinity, statistical methods, and concept level, to determine the sentiment of a document based on a variety of factors, such as its type (Twitter content, Amazon comments, email content, etc.), length, and lexical coherence. Text2Data has been used in various publications examining sentiment analysis web service of tourism, [30] social media analysis on establishment of peace and ceasefire in Colombia, [29] as well as web services for digital health intervention. The relative performance of this instrument in other sentiment analysis research topics bolstered our assumption that it would provide a legitimate response to our research question about the Sentiment Analysis of Airport Service Quality.

C. Research Method

Figure 1 is a graphical representation of the methodology employed in this study. The research methodology begins with compiling Google Maps reviews data that encompasses seven years period, between January 2017 and December 2023. After that, the next step is data preprocessing to filter the collected data and have cleaner datasets. The process proceeds with topic classification before culminating in sentiment analysis.

Despite various data mining deployed in previous studies, the present study focuses on topic modelling before proceeding with sentiment analysis. Topic modelling is used to determine collected data reviews' hidden or latent structures and to correlate such data with eight process names of ACI ASQ [10]. Subsequently, Each ACI ASQ procedure is evaluated using sentiment analysis to determine attitudes, emotional polarity (negative, positive, and neutral), and nuances of a given text. These results are then compared to PT Angkasa Pura II structure-based questionnaire results. This methodology will assist in answering research questions and assisting PT Angkasa Pura II in identifying the most critical element of the passenger experience in the Airport.
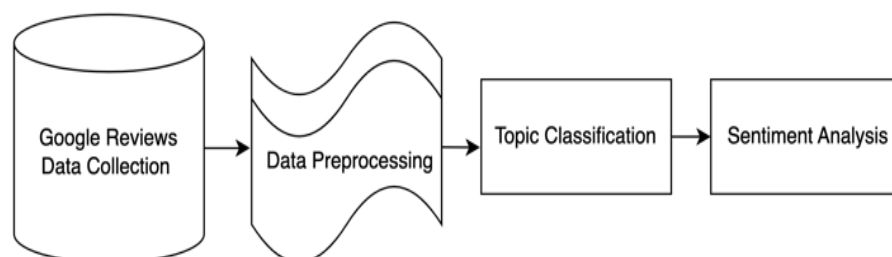

Figure 1. Research Methodology of This Paper

Data Collection

Web scraper on outscraper.com was used to acquire Google Maps reviews data for this research. The reviews included for this study were those submitted on 7 years period between 2 January 2017 until 31 December 2023. This gives a total of 17,481 reviews and is later converted to excel for analysis. If the review is not written in English, outscraper.com will automatically translate the review using Google Translate. The scraped data are reviews identified with place id ChIJCcusWmkCai4R5T_6WYHp3mE on Google Maps. The columns also consist of place name, place_id, location_link, reviews_link, ratings, author_title, author_id, review_text, review_datetime_utc, review_link, review_likes and reviews_id.

In order to compare scraped data with the manual survey conducted by PT Angkasa Pura II, several datasets were also obtained and classified quarterly. These are applicable quarterly figures for 2023. We acquire 1,755 datasets for the first quarter of 2023, 1,676 for the second quarter, 1,722 for the third quarter, and 1,684 for the fourth quarter. These datasets are a subset of this research's complete 7-year data collection. The initial corpus included total location, user id, review date, review ratings, review date, the reasons, date for the visit, and customer comments.

Data Preprocessing

The raw data acquired in earlier rounds comprises of 17,481 Bandara Soekarno Hatta visitor remarks between 2017 and 2023. After constructing a corpus from these review texts, preprocessing was performed to provide a cleaner dataset. The preprocessing includes removal of some columns from the scraped data, such as author_title, location_link, reviews_link and review_likes. This data preprocessing left,review_text and review_datetime_utc for further analysis. Figure 2 is a word cloud illustration of datasets of Soekarno Hatta customer reviews, in which the size of the words is proportional to their frequency of mention.

Topic Classification

Airport Council International defines eight ASQ processes, these are access, check in, passport, wayfinding, facilities, airport environment, arrival and overall. However, based on investigations of previous studies [11][12][13], It was revealed that the ASQ used by those research had been modified to accommodate field data. For example, one publication by Martin-Domingo et al looks at 10 processes by adding people and waiting process for analysis of Twitter datasets [11]. Meanwhile, another research identifies eight indicators, including access, check-in, security, wayfinding, arrival, facilities, environment, and personnel [13]. It removes overall indicator and adds personnel to the body of research. Therefore, this publication acknowledges 8 processes for topic classifications. The processes are access, check-in, security, wayfinding, facilities, airport environment, arrival, and personnel. In addition, passport is eliminated from the ontology of process names and related attributes are merged into arrival.

Meanwhile, word screenings for each of 8 ASQ processes are identified in prior research [11] [13] for the following reasons:

- These two papers have screened a total of more than 260,000 online reviews of airports combine, much more than the total datasets analysed in this research
- Using specific word patterns, such as use symbols of "+" (and) and "-" (or) (For example, clothes + shop) for a sign to help identify different word combinations and patterns. Moreover, classification also includes words that have several forms, for example pickup, pick-up and pick up.
- The datasets evaluated are derived from user-generated content on Google Maps Review and Twitter, whereas the data source for this study is Google Maps.
- These two publications have been published on scopus indexed journal and peer-reviewed to guarantee the methodology's validity.

Finally, classification is performed by categorizing each review on the review_text column comment according to each ASQ process. Each review obtained during data collection is categorized according to the word library as seen on Table 1.

Sentiment Analysis

Text2Data, a tool for sentiment analysis, is used to examine the final dataset, which incorporates the keywords listed in Table 1. These procedures were performed to perform sentiment analysis for this study.

- Each ASQ process is constructed by examining reviews containing words that have been previously categorized based on word library and have a relationship with related ACI ASQ processes.
- Text2Data groups each process into positive and negative categories depending on its dictionary and measurement. Text will be classified as good, negative, or neutral, with a sentiment score ranging from -1 to 1 [30].
- The frequency of each word that has been identified and categorized is counted and then examined according to research questions related to the most relevant ACI ASQ metrics to passengers.
- Text2Data's output determines which ACI ASQ process is most important to passenger experience.
- In the meantime, the quarterly datasets collected in 2021 are being compared to the results of a structured questionnaire administered previously by PT Angkasa Pura II.

Table 1. Topic Classification And Word Library For This Paper

Process Number	Process Name (Topic Classification)	Attribute Number	ACI-ASQ Attribute's Name	Key Words
1	ACCESS	1	Ground transportation to/ from airport	Ground transportation, access + freeway, airtrain, amtrak, bus, cab, commuter, dropoff/drop-off/drop off, ground transportation, lightrail, lyft, metro, people mover, pickup/pick-up/pick up, railway, rental + car, ride share/ rideshare, shuttle, skytrain, subway, taxi, taxiway, train, tram, tramway, uber, van, garage, parking garage, park + car/vehicle, parking, to park, toll booth
		2	Parking facilities	
		3	Value for money of parking facilities	
		4	Availability of baggage cars/ trolleys	
2	CHECK-IN	5	Waiting time check-in queue/ line	Check-in service baggage/luggage + pre-check/check, checkin/check-in/check in/checking in/checked in, check + congestion/line/queue/wait, id check, pre-check lane/precheck lane, ticketing, ticket + agent/counter/kiosk/scanner
		6	Efficiency of check-in staff	
		7	Courtesy and helpfulness of check-in staff	
3	SECURITY	8	Courtesy and helpfulness of security staff	bag check, checkpoint/check point,fingerprint, inspection, metal detector,scan machine, scanner, scanning, security, tsa + congestion/line/queue, tsa precheck/tsa pre check/tsa -pre, tsa +package, tsa + process, tsa + scan/screen/ screening, x-ray/xray
		9	Thoroughness of security inspection	
		10	Waiting time at security inspections	
		11	Feeling of being safe and secure	
4	WAYFINDING	12	Easy of finding your way through airport	Signs & Directions direction, instruction, labeled, layout,map, marked, navigate, navigation, sign,signage, signal, Flight information announcement, display + board, flight + monitor, information + board Mobility access + gate/terminal, arrivals, corridor, departures, elevator, entrance, escalator, exit, get through, hallway, maneuver, movement, pedestrian, roads, traffic, tunnel, walkway,
		13	Flight information screens	
		14	Walking distance inside the terminal	
		15	Easy of making connections with other flights	
5	FACILITIES	16	Courtesy and helpfulness of airport staff	Food & Beverage applebees, bagel, bakery, bar, barbecue, beef, beer, beverage, bistro, breakfast, buffet, burger, burrito, cafe/cafeteria, catering, cheeseburger, chick-fil-a, chicken, chipotle, clam, coffee, croissant, dining, dinner/dinning,
		17	Restaurants/ Eating facilities	

Process Number	Process Name (Topic Classification)	Attribute Number	ACI-ASQ Attribute's Name	Key Words
		18	Value for money of restaurants/ eating facilities	dominos, donut, drink/drinking, drinking/water fountain, dunkin, eatery, eating, espresso, fast food, food, fries, hot dog, latte, lettuce, lunch, mcdonald, meal, meat, milkshake, noodle, onion,oyster, panda express, pepsi/coke, pizza, potato, pretzel, pub, refreshment, restaurant, salad, sandwich, sausage, sausage, seafood, shrimp, snack, soup, spice, starbucks, steak, sugar, sushi, sushi, taco, tequila, tomato, vegetable, vegetarian, vendor/vending, wendy, wine, Washrooms bath, bathroom, men's room, paper towel, restroom, soap, toilet, washroom, women's room, Retail & Shopping alcohol, bookstore, boutique, clothes + shop, commodity, duty-free, gift, grocery, jewelry, lego, liquor, nike, retail, shopping/shops, souvenir, store, underwear, Waiting & Relax area amenities, armrest, cushion, entertainment, facilities, facility, lounge, massage, playground, rest + place, seat, seating, sky club, sleep + chair, smoking, area, sofa, studio, waiting room, Pet relief animal relief, pet area, relief area, Accessible disability, disabled, handicap, wheelchair, Phone & Wi-Fi access & Electronic charge + device, charge station, charger, charging port, device(s), electrical outlet, phone + charging, power/electrical
		19	Availability of bank/ ATM/ Money change	
		20	Shopping facilities	
		21	Value for money at shopping facilities	
		22	Internet access/ Wi-Fi	
		23	Business/ Executive lounges	
		24	Availability of washrooms/ toilets	
		25	Cleanliness of washrooms/ toilets	
		26	Comfort of waiting/ gate areas	
6	ENVIRONMENT	27	Cleanliness of airport terminal	Cleanliness & Environment , ambiance, atmosphere, clean, cleanliness, construction, dirty, environment, hygiene, neat, organized, sanitary, sanitation, sanitized, surrounding, tidy, unsanitary, Air quality & noise air, conditioner, air conditioning, air quality, cigarette, cold, musty, noise/noisy, smell, ventilated, ventilation, Modernization & Aesthetics, aesthetic, airport + old, architecture, arrangement, art installation, artistic, artwork, beautiful, carpet, ceiling, decorate, decoration, design, expansion, gallery, garden, infrastructure, landscape, lighting, modern, modernization, modernize, museum, open air, outdated, renovation, resort, revamp, rundown, scenery, scenic, style, technology, ugly,
		28	Ambience of the airport	
		29	Health Safety	
7	ARRIVAL	30	Passport/ Personal ID inspection	Passport control & Customs, border + control/protect, customs, documentation, immigration, mobile, passport, license, line + customs/passport/immigration, paperwork, passport control, passport + inspect/machine/system, visa, Arrival service & Baggage claim, arrival service/experience, baggage/ luggage + claim/cart/kiosk, baggage, counter/area, carousel, find + baggage/luggage, get + baggage/luggage, line+baggage/luggage, lose/lost + baggage/luggage, luggage counter/storage,pickup/pick up + baggage/luggage, pick up area, trolley, wait + baggage/luggage
		31	Waiting time at passport / personal ID inspection	
		32	Courtesy and helpfulnesss of passport staff	
		33	Speed of baggage delivery service	

Process Number	Process Name (Topic Classification)	Attribute Number	ACI-ASQ Attribute's Name	Key Words
		34	Customs inspections	
8	PERSONNEL			Personnel & Service administrator, agent, assistant, attendance, attendant, cashier, clerk, concierge, crew, employee, employer, everyone, front desk, information booth, manager, officer, officials, people + desk, people + work, personnel, police, policeman, porter, reception, receptionist, screener, server, shuttle driver, skycap, staff, supervisor, ticket counter, tsa folk, valet, volunteer, waiter, waitress, worker,

D. Result and Discussion

This section describes the result of research's data collection, classification and sentiment analysis of eight Airport Service Quality using methodology described

This chapter is divided into multiple subsections, the first of which analyzes 17,481 datasets from Google Maps reviews between January 2017 and December 2023. The next subsections investigate the findings of sentiment analysis for each quarter of 2023. In addition to examining each key indicator's positive, negative, and neutral sentiment, this study examines the frequency with which various traits appear in user reviews used for this study. The increased frequency might be seen as a measure of the significance of Soekarno-Hatta International Airport Jakarta passengers.

Customer Reviews Between November 2017 and December 2023

There are two figures for the first analysis of this chapter. Figure 2 shows relative frequency in which an indicator appears on Google Maps reviews. Furthermore, Figure 3 demonstrates sentiment analysis results for each of ASQ process in Soekarno-Hatta International Airport.

Figure 2 shows that environment aspects are the most mentioned process of ASQ from the passengers by appearing 28% in analysed reviews. It follows closely by facilities with only 5% difference by having 23% occurrence. It appears conceivable that a higher frequency could be interpreted as a measure of the importance that passengers place on each quality. However, the other six processes (access, personnel, wayfinding, arrival, check in and security) have less frequency than those two factors, representing less importance to passengers. The two most frequent ASQ process then mapped to the ASQ attributes listed in Table I, which results on these critical attributes: cleanliness of airport terminal, ambience of the airport, courtesy and helpfulness of airport staff, restaurants/eating facilities, value for money of restaurants, internet access/Wi-Fi, business/executive lounges, availability of washrooms/toilets and comfort of waiting/gate areas.
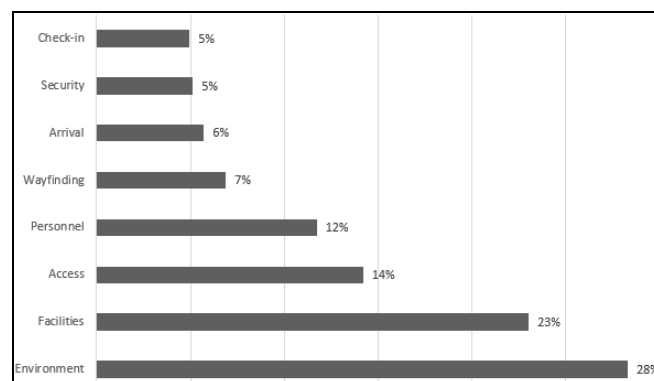

Figure 2. Relative Importance of ASQ Process for Reviews between 2017 and 2023

These statistics can serve as a benchmark for PT. Angkasa Pura II to improve its passenger services. In addition, to align with PT Angkasa Pura II's current initiatives for accelerating future business performance. This benchmark also

demonstrates how to align these corporate initiatives with passenger requirements. It is also important to note that some attributes mentioned above are not handled directly by PT Angkasa Pura II [1], instead being managed by other companies or organizations, for example the food & beverage are handled by third party occupants, business lounges are administered by lounge operators, and tenant and passport control are handled by the Directorate General of Immigration. This demonstrates the necessity of collaborating with third parties to ensure positive experience for each traveller. For these attributes, PT Angkasa Pura II must ensure passenger SLA through signed contracts with the respective service providers. However, in other circumstances, such as Ground Transport, which PT Angkasa Pura II has less leverage. Commonly, airport operators belong to a consortium that deals with this particular issue [13].
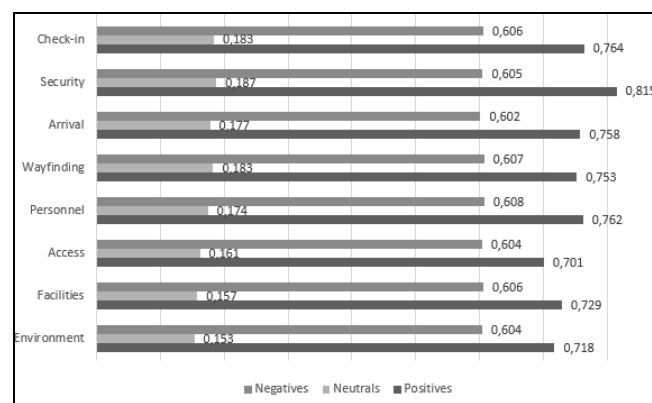
Figure 3. Sentiment Analysis Results by ASQ Process for Google Maps Reviews between 2017 and 2023

Passenger satisfaction with each ASQ process is shown in Figure 3. It shows that passengers give overall positive experience for all ASQ aspects. All processes have more overwhelmingly positive sentiment compared to negative and neutral sentiment. The highest score is security, check-in, personnel, arrival, and wayfinding. This illustrates the achievement of PT Angkasa Pura II in offering good amenities and service transformation to airport travelers. There are several passenger service innovations that may have the potential to contribute favorably to this finding [1] [4] [5].

- Opening of Terminal 3 Ultimate Soekarno Hatta Airport
- Renovation of all gates and areas on Terminal 1 and Terminal 2
- Operation of the Soekarno Hatta International Airport Train from Sudirman Baru Station (BNI City)
- Inauguration of the operating Skytrain linking Soekarno Hatta Airport terminals.
- Increase the number of hotels in the vicinity of Soekarno Hatta Airport
- Additional 21 internal routes and 70 domestic routes for better passenger connectivity

Comparing ASQ Sentiment Analysis with Soekarno-Hatta International ASQ Survery Result

This section compares the findings of the manual quarterly ASQ survey on PT Angkasa Pura II with the analysis of ASQ using sentiment analysis on user-generated content found on the internet. Periodic comparisons are performed for each quarter of 2023. The comparison is made for each quarter because of data availability from PT Angkasa Pura II.

1. **Quarterly Customer Reviews Between January and March 2023 (First Quarter of 2023)**

Figure 4 shows ASQ Factors' sentiment analysis findings, whereas Figure 5 depicts the result of manual survey data compiled by PT Angkasa Pura II
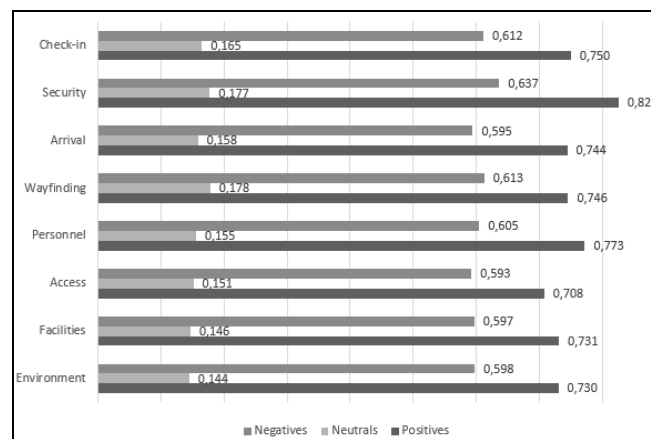
Figure 4. Sentiment Analysis Results by ASQ Process for Google Maps Reviews between January and March 2023

Comparison between sentiment analysis results in Figure 4 and survey results in Figure 5 produces no similarities. While the most positive sentiment analysis result is security and the second most positive sentiment is personnel, then the results of the questionnaire survey show that the ASQ with the highest scores comes from different ASQ processes. The most satisfactory attribute from ASQ Survey Results, namely courtesy and helpfulness for shopping and dining staff with availability of seat at gate area, is an attribute for the airport facilities, the next attribute, which is cleanliness, is subset of environment process. When comparing the results of sentiment analysis to those of a structure-based questionnaire, there are differences between the two results
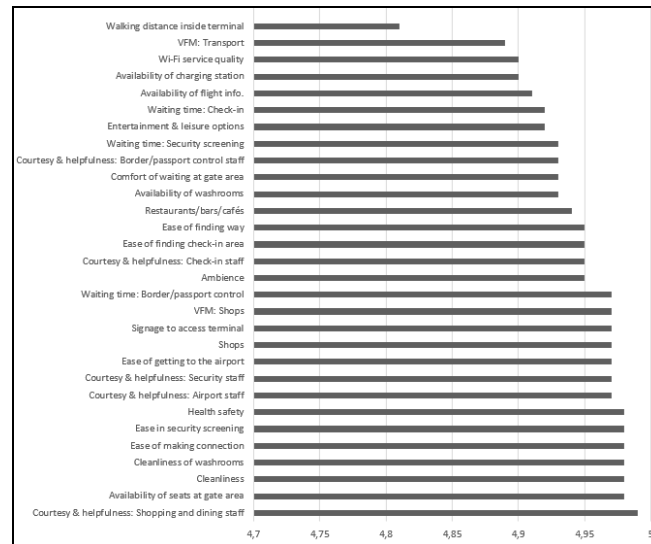
Figure 5. ASQ Survey Results on Soekarno-Hatta International Airport between January and March 2023

2. Customer Reviews Between April and June 2023 (Second Quarter of 2023)

Figure 6 shows ASQ Factors' sentiment analysis findings, whereas Figure 7 depicts the results of questionnaire data compiled by PT Angkasa Pura II for the second quarter of 2023.
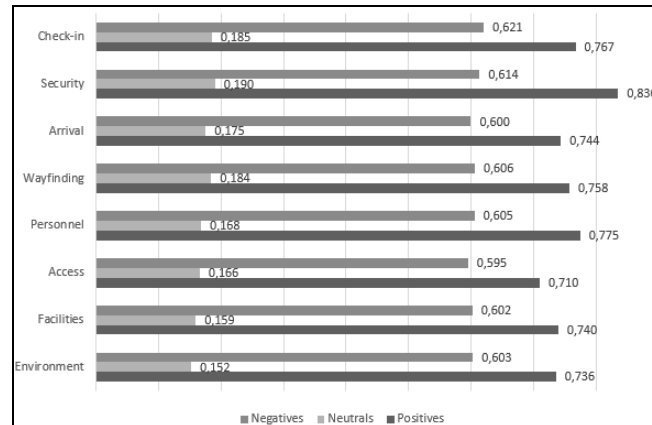

Figure 6. Sentiment Analysis Results by ASQ Process for Google Maps Reviews between April and June 2023

A comparison of Figure 6's Sentiment Analysis results and Figure 7's Survey results reveal also no similarities. While the most positive sentiment analysis result corresponds to security, personnel and check-in process. The questionnaire survey results indicate that the ASQ processes with the highest scores originate from different ASQ processes. The most satisfying attribute, courtesy and helpfulness for shopping and dining staff and health safety, are both an attribute for the facilities process and enviroment process. The third most satisfying attribute, cleanliness are also a subset of the enviroment process.
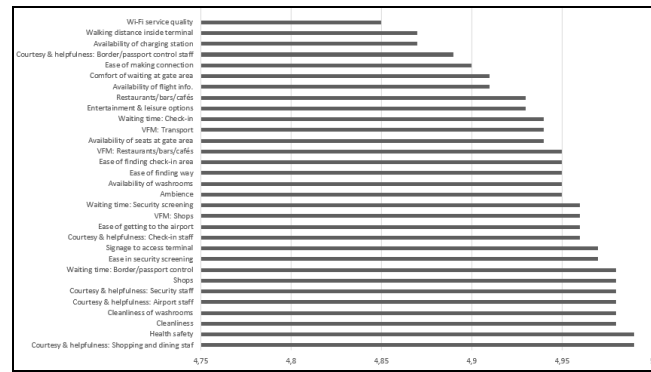
Figure 7. ASQ Survey Results on Soekarno-Hatta International Airport between April and June 2023

3. Customer Reviews Between July and September 2023 (Third Quarter of 2023)

Figure 8 shows ASQ Factors' sentiment analysis findings, whereas Figure 9 depicts the manual survey data compiled by PT Angkasa Pura II for third quarter of 2023
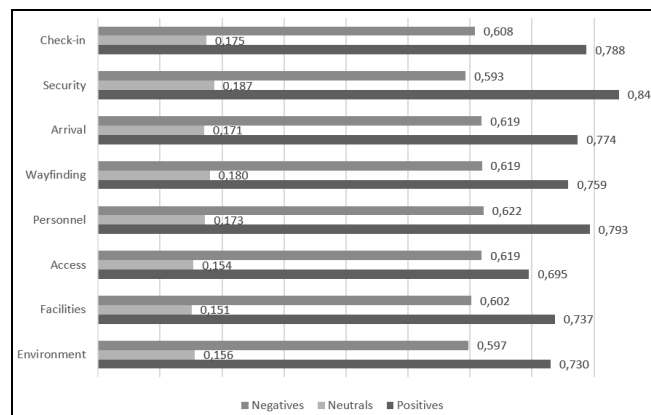

Figure 8. Sentiment Analysis Results by ASQ Process for Google Maps Reviews between July and September 2023

Comparing the results of sentiment analysis and manual survey for the third quarter reveals no similarity. The most positive sentiment analysis result corresponds to security, followed by personnel process. The questionnaire survey results indicate that three most well received ASQ attributes, are part of facilities, environment and arrival process, which are courtesy & helpfulness: shopping and dining staff, health safety and waiting time: border/passport control. While the positive sentiment of arrival process does not have much difference compare to most positive sentiment analysis process for this quarter. In comparison to other processes, the facilities process has comparatively low levels of positivity.
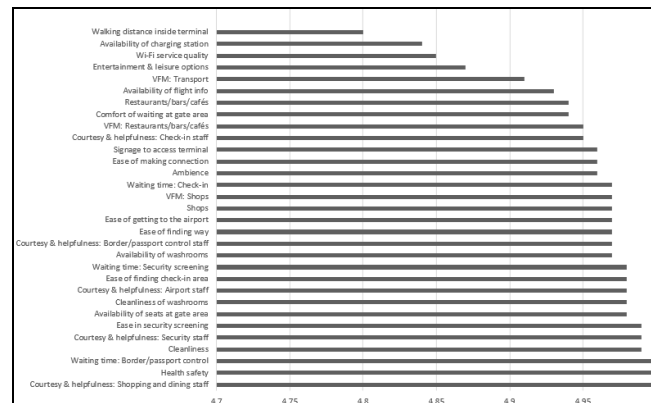
Figure 9. ASQ Survey Results on Soekarno-Hatta International Airport between July and September 2023

4. Customer Reviews Between October and December 2021 (Fourth Quarter of 2021)

Figure 10 depicts the results of ASQ Factors' sentiment analysis, while Figure 11 illustrates the manual survey data compiled by PT Angkasa Pura II for fourth quarter of 2021
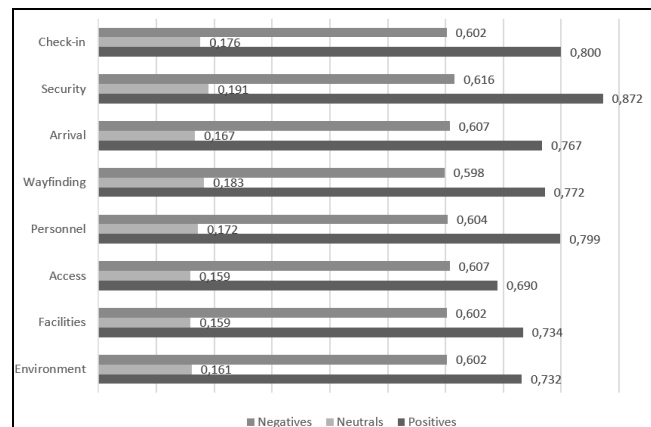

Figure 10. Sentiment Analysis Results by ASQ Process for Google Maps Reviews between October and December 2023

Comparing the results of Figure 10's Sentiment Analysis and Figure 11's Survey for the fourth quarter shows less similarities. While the most positive sentiment analysis result corresponds to security and check-in. Survey results indicate that the most well-received ASQ attributes are part of environment process, which is cleanliness. Meanwhile, the second highest and most positive attributes of survey-based ASQ are courtesy & helpfulness: security staff. These attributes are part of security process. However, environment attribute, which received the most positive feeling according to the survey results, is not among the top three most positive results according to the sentiment analysis.
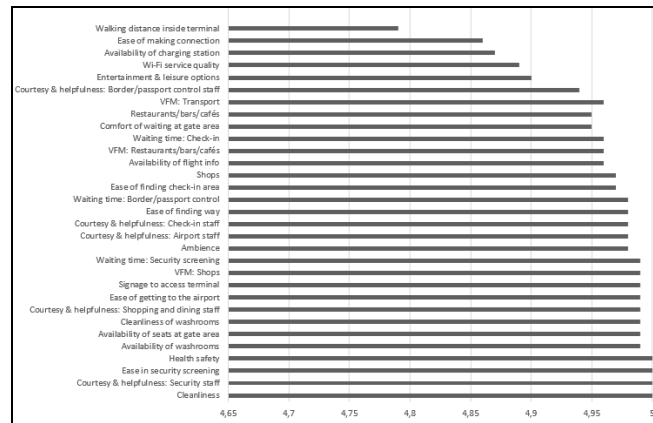
Figure 11. ASQ Survey Results on Soekarno-Hatta International Airport between October and December 2023

Seeing these results, Table II offers a summary of the quarterly comparison between the ASQ Process and the sentiment analysis and structure-based questionnaire for the two highest or two most favorable outcomes.

Table 2. Comparison Of Most Positive ASQ Process Between Sentiment Analysis And Questionnaire

Quarter	Parameter	Result	
		Sentiment Analysis	Questionnaire
First Quarter of 2023	First Position of Most Positive	Security	Facilities
	Second Position Most Positive	Personnel	Facilities
Second Quarter of 2023	First Position of Most Positive	Security	Facilities
	Second Position Most Positive	Personnel	Environment
Third Quarter of 2023	First Position of Most Positive	Security	Facilities
	Second Position Most Positive	Personnel	Environment
Fourth Quarter of 2023	First Position of Most Positive	Security	Environment

Quarter	*Parameter*	Result	
		Sentiment Analysis	*Questionnaire*
	Second Position Most Positive	Check-in	Security

This disparity in the results may be attributable to several factors. The first one is the more extensive questionnaire provided by PT Angkasa Pura II, which covers 31 qualities, as opposed to the sentiment analysis, which is based primarily on eight first-order processes. Even though dividing all datasets into only eight categories provides certain benefits, such as more datasets on each process, this results in an insufficiently deep analysis for each attribute, which impacts the ultimate outcome. Moreover, the structure of Google Maps and the questionnaire can affect the result as well. The structure-based questionnaire provides a survey form that already has points and can influence respondents' responses. Due to the technique and timing of data collection, the questionnaire itself has the potential to introduce bias among respondents [18] [20]. In contrast, Google Maps provides respondents to freely fill up reviews of numerous locations or sites [10][28].

However, this does not mean preventing PT Angkasa Pura II from using social media as a source for ASQ analysis. This study demonstrates that social media data may be utilized to determine the demands of passengers and that social media data can be categorized according to the ACI ASQ criteria. Utilizing online evaluation of existing data is also essential for diversifying survey techniques [10]. Therefore, PT Angkasa Pura II can collect additional information regarding passenger opinions on airport services

E. Conclusion

The The purpose of this paper is to understand passengers' expectations at Soekarno-Hatta International Airport, enabling PT Angkasa Pura II to maintain high levels of customer satisfaction while positively influencing airport commercial activities. This study analyzes the most commonly stated Airport Council International (ACI) Airport Service Quality (ASQ) indicators mentioned in social media reviews, alongside the sentiment expressed around these variables. It also contributes to the research domain by comparing ACI ASQ aspects identified in social media reviews with findings from PT Angkasa Pura II's quarterly paper-based questionnaires.

The analysis, based on Google Maps reviews, identifies airport facilities and environment as the most frequently mentioned ASQ factors at Soekarno-Hatta International Airport. These factors encompass 13 attributes, including terminal cleanliness, airport ambience, staff courtesy, restaurant value, Wi-Fi access, executive lounges, washroom availability, and waiting area comfort. While these findings underscore passengers' priorities, the study also highlights specific areas for improvement, such as restaurants, shopping facilities, Wi-Fi, and washrooms, which received negative reviews. To address these concerns, PT Angkasa Pura II can prioritize maintenance budget allocations toward enhancing these critical

services. Additionally, collaboration with external entities managing passenger touchpoints is essential to ensure consistent positive experiences.

The research reveals that ASQ values derived from structure-based surveys may differ from those obtained via sentiment analysis of social media channels. This discrepancy stems from the distinct formats and scopes of the Google Maps reviews and the traditional questionnaires. By integrating sentiment analysis with conventional survey methods, PT Angkasa Pura II can gain a more comprehensive understanding of passenger feedback. Utilizing online reviews diversifies survey methodologies, providing valuable insights into passengers' opinions and helping the company continually improve its services to meet evolving expectations

F.   Limitations

This article also has several limitations, the first of which relates to the evaluated ASQ processes. This study examines just eight major ASQ processes without investigating further into each ASQ's 34 features. These decisions are meant to guarantee that the retrieved data can be accurately classified without additional bias from the authors. However, it also impedes the authors' ability to examine each potential ASQ component thoroughly. In addition, this research also uses topic ontology developed by previous publications from different countries. This may result in the identification of ASQ subjects that is not always correct. More exhaustive and systematic word screening may assist subsequent publications in delving further into this area

G.   Acknowledgment

H.   References

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