

Customer Satisfaction Analysis Using Quality Function Deployment: A Case Study on Malaysian Domestic Airlines

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DOI: <https://doi.org/10.30880/ekst.2022.02.01.007>

Received 20 June 2021; Accepted 29 November 2021; Available online 1 August 2022

Abstract: In this age of globalization, airline service quality has become a popular issue in the global air transportation industry. Due to the intensely competitive market situation, the airline company requires to focus on the passenger's experience and satisfaction. This study attempts to conduct a customer satisfaction analysis by using quality function deployment as a case study on Malaysian domestic airlines. The data of three Malaysian domestic airlines; AirAsia (217 observations), Malaysia Airlines (215 observations) and Malindo Air (242 observations) were collected from the Skytrax website from June 2013 to January 2020. The word "Service" is found to be the most frequent word that appears in the passengers' review on Malaysian domestic airlines through the text mining analysis. Quality function deployment was adopted to systematically determine the priority in customer requirements through the development of house of quality. Based on the relative importance of customer requirements, value for money had been determined to be the priority. The house of quality formulates a service planning matrix beneficial to Malaysian domestic airlines. It provides a guideline to focus on, i.e. the specification improvement on their service performance to enhance customer satisfaction.

Keywords: House of Quality, Service Planning Matrix, Malaysia Domestic Airlines

1. Introduction

For more than a decade, transportation is a fundamental element to society where it is closely related to human lifestyle such as connecting people to jobs, education and leisure facilities [1]. In the advancement of transportation, it has gradually transformed the people's living standard and restructured the community with a great effect on civilization development. People can travel from one country to another without issues due to the rapid traveling modes available in this advanced age. According to the annual report of the International Civil Aviation Organization (ICAO) in 2018, the total number of global passengers in scheduled airlines had increased from 4 billion passengers in the year 2017 to 4.3 billion passengers in the year 2018. As the total number of air passengers has grown significantly worldwide, there will be many

opportunities as well as challenges for the economic entities in the airline industry. The opportunities will arise due to the passengers' high expectations of airline services. Meanwhile, the challenges may not only come from intense competition among the airline companies, but may also come from the customers' desire for better service quality. Most airline companies will provide in-flight services to their passengers as an additional benefit to enhance their passengers' flight experience. More specifically, the in-flight service factors do not only include food service, in-flight entertainment, onboard facilities, service performance, and flight attendants; they also include ground service factors such as check-in service, baggage services, guest lounges, and frequent-flyer programs [2].

In-flight service and ground service represent a comprehensive airlines management system to improve customer satisfaction. Airline companies should continuously improve their service performance to increase sustainability, profitability, and economic development [3]. According to [4], the quality function deployment is defined as a design process capable of capturing and understanding the requirements of the customers. This is done by using a diagram-linked matrix to deliver important information. This statement is supported by several studies such as [5] and [6] where they claimed that the main characteristic of quality function deployment is to collect the voice of the customers for the determination of technical requirements during the development of a service or product. Based on the studies of [6] and [7], companies are interested in quality function deployment because this method could lead to reduced cost of production and decrease the probability of failure of the organizations.

Additionally, several studies such as [8] and [9] have also chosen quality function deployment as their studies' topic. Both studies examined its implementation in many sectors such as the food industry and airline industry in improving the industries' quality of services and products. Meanwhile, [10] used the technique of quality function deployment in the planning procedure of civil engineering tasks; in which it improved the research and development process of the company. In conclusion, the technique of quality function deployment can be implemented widely in different sectors. However, it does not represent a methodological technique in real life. This is because it is a universal concept that provides the voice of customers that translates into product and service development [11].

Therefore, this study aims to formulate the service planning matrix based on customer satisfaction analysis by using quality function deployment. The high living standard that exists among the community members has raised the people's desire to receive excellent service quality. However, the process of understanding the customers' expectations as well as the performance of service quality are the real challenges. This is because customer satisfaction is determined through intangible factors that could not be perceived by the senses especially the sense of touch and sight. In real life, customer complaint is the most unlikely situation that occurs in all companies especially in the service industry. Unfortunately, this often occurs in companies that are incapable of meeting their customers' expectations and satisfaction. The customers will tend to procure the services of other airline companies that provide excellent service performance and satisfy their expectations. Customer satisfaction may unconsciously change when customers experience the services provided by Malaysian domestic airlines. Thus, a clear understanding of customer behaviour will lead to the improvement in services that previously have been unsuccessful to achieve customer satisfaction. The understanding could also lead to the identification of the main services capable of fulfilling the customers' requirements in the current market demand.

2. Materials and Methods

2.1 Data Description

Skytrax website (<https://skytraxratings.com/>) is an organization of international air transport rating established in the year of 1989 and is located in London, United Kingdom. The data of Malaysian domestic airlines were collected from the Skytrax website that comprised of AirAsia, Malaysia Airlines

and Malindo Air. The AirAsia consist of 217 observations collected from April 2015 to January 2020 represents a low-cost carrier, while Malaysia Airline consists of 215 observations collected from September 2013 to January 2020 and Malindo Airline consist of 242 observations collected from June 2013 to January 2020 both represent full-service carriers, and they are the focus of this study. The information behind the data through an online survey assessment related to airline service quality after passengers directly served by each of the airlines. In the online survey assessment, passengers can rate as a Likert scale from 5=Very satisfied, 4=Satisfied, 3=Neutral, 2=Dissatisfied and 1=Very dissatisfied based on the seat comfort, service of cabin staff, food and beverage, ground service, value for money and customer recommendation beyond that customer recommendation presented as categorical data. In short, passengers can comment on their overall flight experience, satisfaction and perception in the online survey assessment and review by text.

Table 1: Data Descriptions

No.	Variables	Data Type	Descriptions
1	Seat Comfort	Qualitative (ordinal)	Rating of seat comfort
2	Cabin Staff Service	Qualitative (ordinal)	Rating of the in-flight service
3	Food & Beverage	Qualitative (ordinal)	Rating of the quality of the in-flight food and beverages
4	Ground Service	Qualitative (Ordinal)	Rating of the service on the ground before and after the flight
5	Value For Money	Qualitative (Ordinal)	Rating of the value of airline against the price of a ticket
6	Recommend	Qualitative (Nominal)	Recommend the airline company to passengers.
7	Review	Qualitative (Text)	Overall flight experience and expectation

2.2 Association Analysis

Association analysis is used to analyze the strength of relationships hidden in huge data sets [12]. In this study, association analysis is implemented to analyse the direction and association between service attributes and customer satisfaction in three Malaysian domestic airlines. Cramer's V Coefficient is chosen as the collected data represent ordinal data; in which categorical variable consists of three or more levels with natural ordering. This statement is supported by [13].

Skytrax online survey assessment has applied the 5-point Likert scale. The item is used to come up with a quantitative measure of a personal trait [14]. Therefore, the Cramer's V Coefficient is a suitable method in analyzing the direction and association between service quality and customer satisfaction in this research.

2.3 Text Mining Technique

According to [15], text mining is defined as a technique used to discover and extract unknown information from different written sources. It is a tool to detect and delete the abnormality present in the data throughout pre-processing and cleaning operations. The text mining technique is also a type of data mining approach capable of extracting interesting patterns from the database to drive the analysis in order to help organizations improving the process of decision making [16]. By implementing a text frequency analysis, the frequency of words that appear in the customer reviews will be calculated using statistical software of text mining such as Rstudio to extract meaningful information from textual data.

2.4 Quality Function Deployment

The quality function deployment is an effective management technique that provides a process of visual connection where it focuses on the customers' needs throughout the process of the total development cycle [17]. In each step of the service development and production phase, the quality function deployment is translating the requirement of the customers into the adequate technical requirement such as product design and development of the production process.

2.5 House of Quality

The house of quality is defined as a process of quality function deployment based on the matrix framework. Figure 1 shows the framework of house of quality.

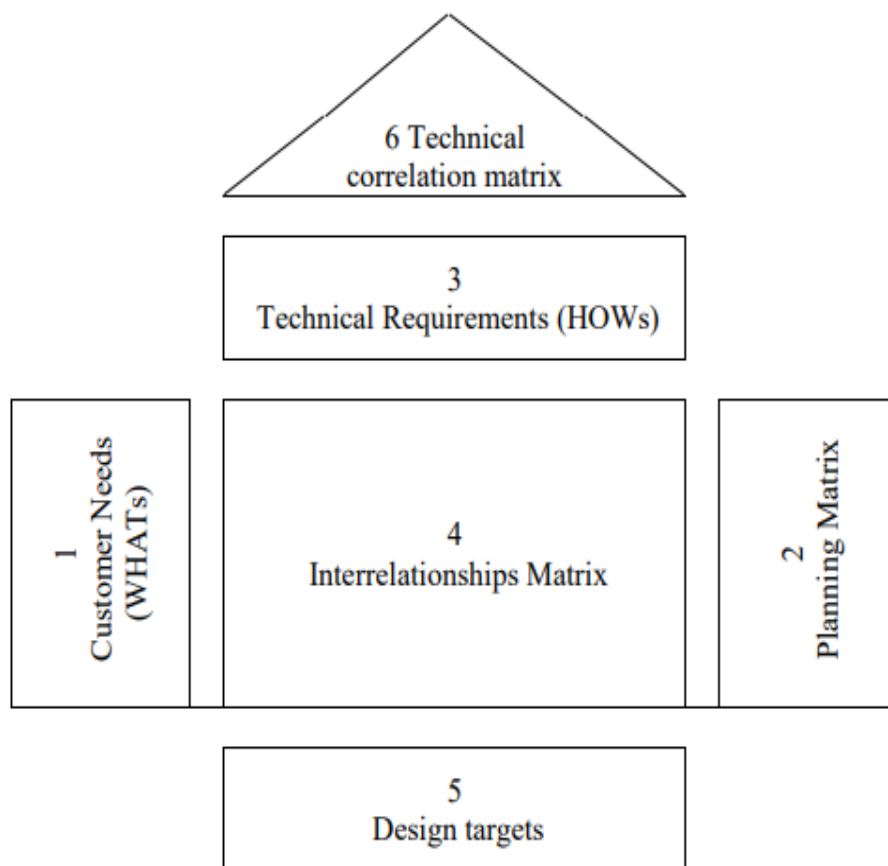


Figure 1: Framework of House of Quality

It is the process of understanding the voices of the customers and translating their requirements into a service plan matrix. It shows only a basic framework of the house of quality, and the skeleton can flexibly be expanded vertically and horizontally based on the properties of the institution and its market [18].

2.5.1 Customer's Requirements

The customers' requirements of AirAsia can be identified by using customer reviews from the Skytrax website, and each of the customer requirements has different priorities extracted through the

text mining technique. The association analysis was used to shows the strength of the association between the service attributes and customer recommendation in three Malaysian domestic airlines companies. The higher score of association analysis, the higher the rating value for the relative importance of customer requirements.

2.5.2 Planning Matrix

The planning matrix is also known as the relative importance of competitor assessment is one of the most significant elements in the House of Quality diagram [19]. Malaysia Airlines and Malindo Air act as competitor airline companies towards AirAsia. While the competitor's airlines consist of various customer requirements and priorities with a scale of 1 (least important) through 5 (most important) by using association analysis to determine the competitor airline assessments. This process is capable to evaluate the performance of AirAsia and the competitor’s companies in similar service attributes on the customer requirements.

2.5.3 Technical Requirements

The customer requirements are transforming into the technical requirement are conducting in this section [20]. In the process of technical requirements, supporting material sources such as the annual reports from the world’s top leading airline were analyzed. These reports allow the assignment of company measures, design of requirements, engineering characteristics, and service attributes that are closely related to evaluate the customer requirement, and for benchmarking. This will show the companies’ competitiveness relative to their competitors.

2.5.4 Interrelationships Matrix

The purpose of the interrelationship matrix is used to determine the relationship between the customer requirements and the technical requirements in the middle component of house of quality. This can be determined based on supporting resources and information such as experts' experience, customer recommendations, and statistical studies or experiments [18].

Table 2: Level of Relationship

Level of Relationships	
Strong	●
Moderate	○
Weak	▽

Figure 2 shows the symbol used in this study to build the house of quality. In this study, it can be determined through several world top 10 airlines annual reports that summarized by a field professional with assigning it with three types of relationship levels; those are weak relationship, moderate relationship, and strong relationship as 9-3-1 weighting factors.

2.5.5 Design Target

The design target comprises two crucial elements such as relative importance rating of technical requirements and technical competency assessment will be discussed below.

2.5.5.1 Relative Importance Rating of Technical Requirements

The main purpose of relative importance rating for technical requirements is used to measure the strength of the technical requirement that is associated with customer’s requirements for AirAsia. These results will be placed in respective columns to identify the significance for each of the technical requirements using the following equation [21].

$$\Sigma \text{ Importance Rating of Customer Requirement} \times \text{Interrelationship Matrix} \quad \text{Eq.1}$$

2.5.5.2 Technical Competitive Assessment

The technical competitive assessments are implemented to evaluate a service’s technical performance and the competitor’s service performance with similar technical requirements [22]. This stage involves reverse-engineering on the competitors’ service to identify the values for technical competitor assessment by the scale of 1 (least important) to the scale of 5 (most important). This will give the understanding of whether the technical assessment of Airasia is better or worse than Malaysia Airlines and Malindo Air.

2.5.6 Technical Corrections Matrix

The technical correlation matrix is used to determine the inter-relation and the strength of relationships between each of the technical requirements [23]. Based on [24], this stage can be obtained by the professional based on their experience or logical thinking to determine the stage of technical corrections.

Table 3: Level of Relationship

Level of Relationships	
Negative Relationship	-
No Relationship	
Positive Relationship	+

There are three types of technical relationships used such as negative relationship, no relationship, and positive relationship. These correlations are indicated using different symbols as can be seen in Table 3. The positive relationship represents that those pairs of technical requirements are closely related. The negative relationship represents those pairs of technical requirements that are negatively related. Generally, the presence of many positive relationships shows that may duplication in either the requirements of customer or technical.

3. Results and Discussion

3.1 Association Analysis

Table 4 shows the magnitude and direction of correlation between customer recommendation and five service attributes using Cramer’s V coefficient.

Table 4: Cramer's V coefficient of Malaysian domestic airlines

Test Statistics	Attributes	Cramer's V Coefficient (Rank)		
		AirAsia	Malaysia Airlines	Malindo Air
	Seat Comfort	0.476 (2)	0.747 (4)	0.673 (1)
	Cabin Staff Service	0.506 (4)	0.637 (1)	0.715 (4)
	Food and Beverages	0.464 (1)	0.697 (2)	0.677 (2)
	Ground Service	0.493 (3)	0.743 (3)	0.701 (3)
	Value for Money	0.590 (5)	0.827 (5)	0.862 (5)

The findings show that there is a statistical association between all of the service attributes and customer recommendations in the three Malaysian domestic airlines. Therefore, the null hypothesis stating no statistical association between service attributes and customer recommendations was rejected. Meanwhile, Cramer's V coefficient shows that the overall strongest correlation is between all of the flight service attributes and customer recommendation in three Malaysian domestic airlines at a significance level of 0.05.

3.2 Text Mining Technique

The text mining technique is implemented to discover the unstructured passenger online reviews into valuable information by using the statistical software of Rstudio. The keywords frequency for the recognition of airline passenger reviews on three Malaysian domestic airlines.

Table 5: Top 3 frequent words of airline passenger review

Malaysian Domestic Airlines	Word	Frequency	Rank
AirAsia	Service	22	1
	Good	20	2
	AirAsia	13	3
Malaysia Airlines	Service	32	1
	Good	31	2
	Crew	18	3
Malindo Air	Service	20	1
	Crew	16	2
	Staff	14	3

For the data analysis of customer reviews from three Malaysian domestic airlines, the first procedure is extracting the keywords by using the text mining technique and calculate it by using frequency analysis. Based on the result shown in Table 5, it was found that the word "service" represented as the most frequent word appear in the passenger's review of AirAsia, Malaysia Airlines and Malindo air. Obviously, the service performance by airline service performance acts as the main focus of attention from customers to create a good reputation in the market of the airline service industry. It can be portrayed as a part of the airline business that must be handled well at all times to keep up the image of the airline's company throughout their airline service performances.

3.3 House of Quality

The house of quality is defined as an overall concept and process of quality function deployment based on the matrix framework which is a process of understanding the voice of the customer and translating their requirement into a plan. At first, the customer requirements are collected from international air transport rating (Skytrax) included rating and review of passengers around the world and categories into five categories as Table 6.

Table 6: Summary of Customer's Requirement (CR)

Attributes	Descriptions of CR
Seat Comfort	Provided Comfortable Seat Space
	High Level of Seat and Cabin Cleanliness
Cabin Staff Service	Professional and Experience Cabin Staff
	Comprehensive Cabin Service
Food and Beverages	High Availability of Meals Choices
	Standard and Quality of Meals
Ground Service	Standard of Customer Service
	Good Time Management of Ground Service
Value for Money	Low Fare Flight Ticket
	Good Price-Performance Rate

Refer to Table 4 and Table 6 shows the findings of value for money is recorded as the highest importance of customer requirements in AirAsia which is similar results to Malaysia Airlines and Malindo Air. Meanwhile, the food and beverages had been rated as the lowest importance of customer requirements in AirAsia that is different compare with its competitor's companies. In short, majority of the customers are more emphasized on flight tickets value as well as the price-performance rate in order to satisfy their requirements and satisfaction on three Malaysian domestic airlines companies.

Table 7: Technical Requirements

Attributes	Technical Requirements	Relative	Technical competitive assessment	
		Importance Rating (%)	Malaysia Airlines	Malindo Air
Seat Comfort	Ergonomic Design of Cabin Seat	9%	2	5
	Retrofit Program for Passenger Seat Design	9%	2	5
Cabin Staff Service	Innovative Work-Style Reforms	12%	5	2
	Cabin Crew Management Programme	10%	5	2
Food and Beverages	Improving the Quality and Variety of Food and Beverages Available Onboard	6%	4	4
	Personalisation in In-flight Dining	6%	4	4
Ground Service	Functional, Annual and International Civil Aviation Organization Training	17%	3	3
	Modernization of Ground Infrastructure	7%	3	3
Value for Money	Launched Low-Fare Promotions Program	12%	1	1
	Flexibility Flight Service Selections	12%	1	1

The technical requirements are summarised from the world's Top 10 Airlines of 2019 used to determine the comprehensive technical solution to enhance the three Malaysian domestic airlines' service performance. After summarizing the technical requirement, the interrelationship matrix between customer requirements and technical requirements is adopted to determine the degree of relationship between each of the customer requirements and each of the technical requirements to improve the airline's service quality and a technical correlation matrix is also used to determine interrelated relationships between each of the technical requirements. The results can be seen in Figure 2.

According to the results from Table 7, the “Functional, annual and international civil aviation organization training” recorded as the highest absolute weight (17%) of relative importance rating of technical requirements followed by “Innovative work-style reforms” (12%) and “Launched low-fare promotions program” (12%) and “Flexibility flight service selections” (12%). As for “Cabin crew management program” recorded as (10%) of absolute weight in relative importance rating of technical requirements which followed by “Ergonomic design of cabin seat” (9%), “Retrofit program for passenger seat design” (9%), “Modernisation of ground infrastructure” (7%). Lastly “Improving the quality and variety of food and beverages available on board” and “Personalization in In-flight dining” are recorded as the lowest absolute weight (6%) in relative importance rating of technical requirements. These results can largely contribute to determining the fundamental of service requirements and the process of decision-making for Malaysia's domestic airline company.

Furthermore, it can be also summarised the value for money recorded as a priority technical requirement in Malaysia Airlines to satisfy the customer requirements followed by seat comfort, ground service, food and beverages while the least priority technical requirement in Malaysia airlines recorded as attributes of cabin staff service. The value for money was recorded as priority technical requirements in Malindo Air which same as Malaysia Airlines and followed by cabin staff service, ground service, food and beverages while comfort was recorded as the least priority technical requirement in Malindo Air. Develop a well understanding of the competitor's technical assessment can give rise to benign competition and cooperation between the competitors to improve the company's service performance as well as enhance the global consumer repurchase intention towards the airline company [25].

In this research study, the quality function deployment is a very beneficial approach to be adopted in the service planning matrix design for three Malaysian domestic airline companies. It assists to systematically streamline the service design information, establish interrelationships between the service requirements as well as technical requirements which can be controlled to satisfy the passenger's requirements. Based on the findings of quality function deployment for the service planning design, it can be observed that value for money plays the most important attribute in comparison to other customer requirements. Three Malaysian domestic airlines can obtain a deep understanding of customer's expectations and perceptions in order to improve the overall airline's service performance in this changing environment.

3.4 Service Planning Matrix

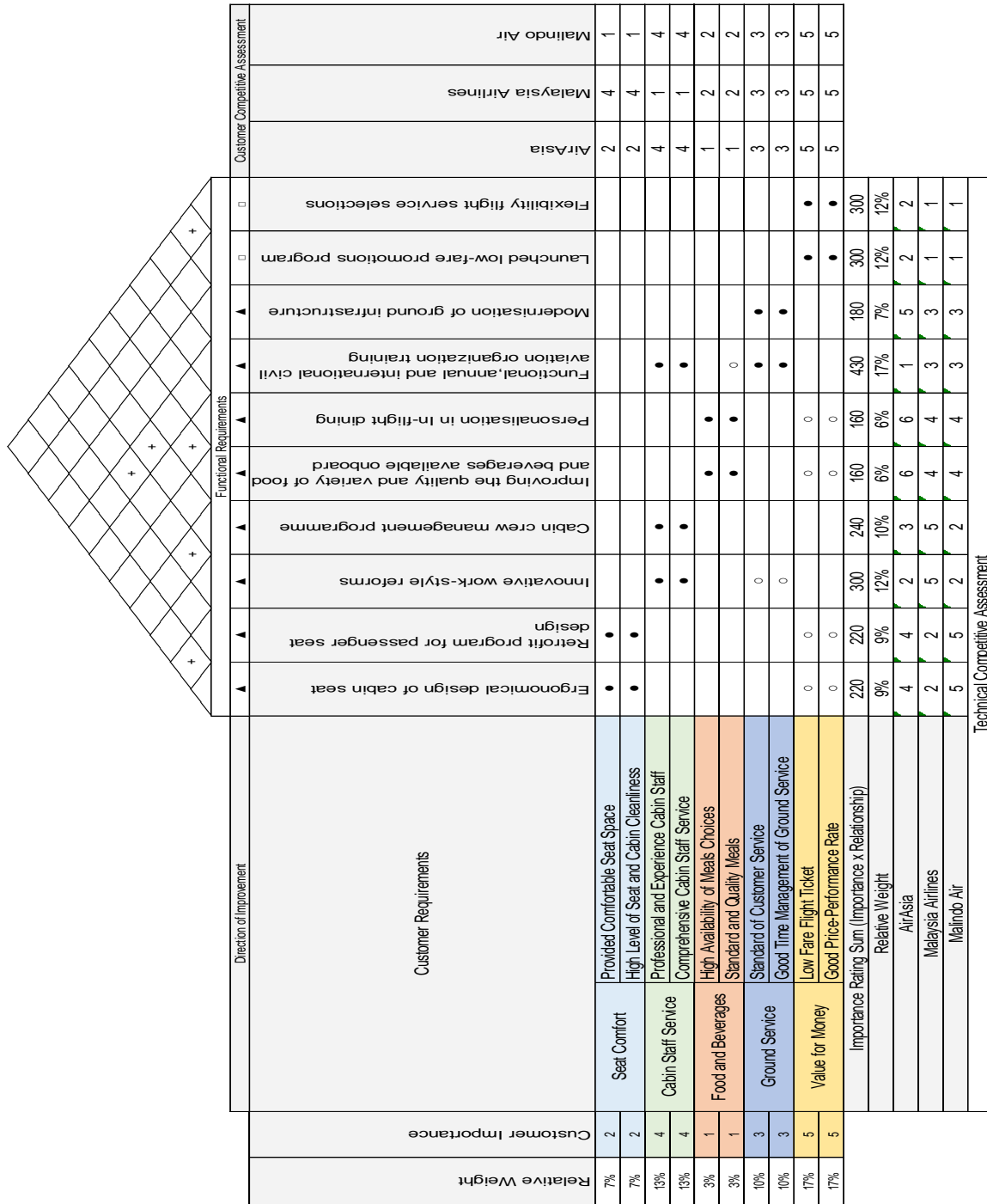


Figure 2: House of Quality

4. Conclusions

In this research, it can be concluded that by using the association analysis, the significant association between the five service attributes and customer recommendation in the Malaysian domestic airline has been determined. This study revealed that there is a significant association between customer recommendations and the five service attributes such as seat comfort, cabin staff service, food and beverages, ground service and value for money. For the data analysis on passengers' reviews of three

Malaysian domestic airlines, the first procedure is to extract the keywords through the using of text mining techniques and frequency analysis. Based on the result, it was found that the word “service” is the most frequent word appearing in the passengers’ review. Therefore, it could be stated that ‘service’ is a part of airline business operation that must be at a preferable level at all times so that the image of the company is sustained. This could be done through various management and organizational training.

Apart from that, quality function deployment is proposed to translate the customer requirements into technical requirements. Additionally, it is also vital to identify the priority of each technical requirement in the three Malaysian domestic airlines. Hence, to derive the rankings of customer requirements and the relevant technical requirements is an important process of quality function deployment. The development of several technical requirements can effectively improve the Malaysian domestic airlines’ service quality. This could be done by imitating the approach of the world's Top 10 Airlines. In this study, the most important technical requirement is "Functional, annual and international civil aviation organization training” where the delivering of good service quality to global customers is emphasized. Various types of professional training programs and intensive talent management programs should be prepared to improve service quality and satisfy passenger expectations. Consequently, every service attribute adopted by this study plays a vital role in customer satisfaction. Future research could include additional service attributes with different aspects to obtain a more comprehensive and informative result. In this research, it can be concluded that customer satisfaction is sensitive to the service quality provided by the three Malaysian domestic airline companies.

Acknowledgement

The authors would like to thank Universiti Tun Hussein Onn Malaysia for providing the research of TIER 1 H785. The authors are also extremely thankful to the reviewers for their beautiful remarks.

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