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Enhancing In-Flight Customer Experience by Integrating Kano Model and Quality Function Deployment Method into Airline Service Quality

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Abstract

The purpose of this paper is to timely understand how passenger needs have changed and what is more important during their journey to enhance airline service quality. In a new era of aviation, where airline customer perceptions have changed as they have gone through the certain crisis, it is necessary to understand the changing of customer requirements that have changed over time according to the environment they are in. Delivering the satisfied customer experience by understanding the dynamic changes of customer requirement is the key to enhance satisfaction. In order to meet customer expectations and achieve highest quality levels, the aim of this research article is to identify in-flight customer experience that is aligned with customer's needs along with in-flight service capabilities from providers to deliver the customer service experience. Ethnography is employed to understand the dynamic changes of customer requirement. Kano model is applied to analyze in-flight service attributes by customer perception surveying to determine their satisfaction. Quality function deployment and DEMATEL are research tools to link the relationship between customer requirement and service capabilities to sustainably enhance in-flight service quality. The result implies significance of hygiene as service dimension in post-Covid. In-flight cleanliness and hygiene, hospitality and service minded and complimentary high-speed Wi-Fi are the most attributes required from customer when travelling. Meanwhile, sufficient rest before next duty for physical recovering, mitigating intensity of cabin and service tasks including comfortable facility of aircraft features are determined as in-flight service capabilities from service providers to achieve the customer requirements.

Keywords
In-flight service quality, full-service airline, Ethnography, Kano and Quality Function Deployment

1. Introduction

With the passage of the unprecedented crisis Covid-19 that slow an aviation's growth down since 2019, aviation has moved on and returned to profitability in 2023 after few years of remarkable losses (IATA, 2024). According to IATA (2024), the latest industry's revenues has expected to reach an historic high of $996 billion with expected air passengers to reach 4.96 billion in 2024. Even though the revenues and travel demand are positively increasing, there are some global uncertainties that can potentially slow the growth down again such as rapid technological change, economic uncertainty, a warming planet and conflict (The Global Risks Report, 2024). Thus, on the path to strengthen the airline profitability and performance in a world of many and growing uncertainties, paying an attention to passenger perceived service quality and providing seamless customer journey are now essential key successes of airline efforts to improve performance. In this regard, to shaped the industry's growth and deliver service efficiency to airline customers, this study places a greater emphasis on dynamic changes in term of customer satisfaction due to the emergence of global crisis and growing uncertainties, which is conducive to dynamic observation of passenger behaviors. This study employs an Ethnography to understand the certain dynamic changes of customer requirement by mean of intensive participant observation. Kano model is applied to gain more comprehensive results of customer satisfaction by classifying customer satisfaction, as each of them affects customer satisfaction in a different way. Basic needs attributes or traditional service quality requirements such as seat, in-flight meal and beverage, cabin cleanliness and cabin crew are still concern concurrently alongside of changing customer requirements. This present study attempts to address this knowledge gap. Additionally, by views of academics and practices, service providers who play an important role on how to deliver satisfied service quality to customer have been largely ignored. Their satisfaction, feeling and positive attitude are also significant in term of achieving and empowering sustainable service quality and performance. Thus, in this study, both sides understanding has been addressed. Quality Function Deployment (QFD) is applied to provide sufficient analysis from expert's perspective in order to establish priorities in a proper way to fulfill the customer requirement.

1.1 Objectives

This study attempts to address multiple and significantly contributes to the field of airline service quality. Firstly, this study contributes to fill research gaps from the existing literature by extending the limited research concerning customer-related study after 2023 where measuring in-flight service quality needs to be up to date. This study proposes an application of both Ethnography and Kano to enlarge an understanding of an actual customer behaviors that have constantly changed over time. More comprehensive of customer needs is addresses for measuring customer satisfaction which is influenced by perceived service quality. Additionally, most of previous studied has mainly emphasized on how to examine customer needs in order to enhance business's service quality, this study further investigates service performance driven by service providers to achieve the aim. The result of the study can be further contributed to service providers' onboard practices which enables service providers such as in-flight cabin attendants and cabin service supervisors to prioritize their service focus and concern in order to enhance their onboard practices. Lastly, this research stands out through its dedicated for an aviation resilience and is applicable to airline strategies to mitigate uncontrollably future risks such as weather condition; severe turbulence or possibly recurrent disease. This contributes to retain customers and strengthen relationships no matter what unknow or unsuspected crisis may arise causing an operational disruption again.

2. Literature Review

2.1 Service Quality in Aviation

Parasuraman et al. (1988) defined service quality as the quality perceived in a service to be a function of the gap between consumers' expectations of the service and their perceptions of the actual service delivered called "SERVQUAL" that has been widely used in different industries, including aviation industries. In the context of airline service quality, the SERVQUAL model has been used to traditionally measure the perceived service quality. The service quality functions performed by the airlines can encompass various activities, such as ticket reservation, purchasing, check-in, comfortable including safe travelling and value-added services such as in-flight services, in-flight entertainment, seat comfort, and cleanliness, luggage transportation (Percin, 2018). According to Park (2020), the findings of the study to understand the dynamics of the quality of airline service attributes have determined that the quality of certain service attributes, such as cleanliness, food and beverages, and in-flight entertainment affects the variations of positive ratings as a satisfier. However, in a new era of aviation, where airline customer perceptions have changed over time according to the environment they are in and what they have gone through, understanding the changing of customer requirements is necessary to enhance service efficiency and quality. The recent comparative study employing SERVQUAL model showing that air passenger's perceptions of airline services have been changed from pre-pandemic as responsiveness of airlines has become the most crucial dimension (Kim, 2024). The studies in 2023 have shown that customer' expectations have been constantly changing and shifting, driven by the applications of new technologies in aviation, the increasing awareness of environmental problem and most recently, the influence of Covid-19" (Zhang, 2023). Additionally, the significance of hygiene as a service dimension in post-Covid has also been emphasized as cleanliness and hygiene became the top priority and bore a high value to consumers, in-flight hygiene should be the main focus of an airline in maintaining its service quality level (Lopez-Valpuesta & Casas-Albala, 2023).

2.2 Kano with Satisfied In-Flight Customer Requirements

Kano et al. (1984) proposed six types of categorization: Must-be (M), Attractive (A), One-dimensional (O), Reversal (R), Indifferent (I), and Questionable (Q) with each type having a different impact on customer satisfaction. Kano presented a functional and dysfunctional questionnaire. Functional question encapsulates customers' feelings when quality attributes are offered by a product or service, while dysfunctional question functions when quality attributes are not offered (Tahanisaz et al., 2020). According to HSU (2007), the application of Kano in airline industry determines customer needs and classifies customer requirements that clear and precise cabin announcement and correct safety demonstration are considered as must be attributes. Meanwhile, cabin crew, various food choice on the menu, internet, good quality of in-flight meal, seat comfort and new aircraft type are being considered as one-dimensional attributes. In this study, Kano's model is employed to capture airline's customer voice in the currently dynamic changing situation when travelling. Similarly, potential benefits of Kano allow to see how it may not be enough to merely satisfy customers in nowadays.

2.3 Quality Function Deployment (QFD) and DEMATEL to Construct a Relationship Network

According to the study "QFD: Past, Present, and Future" by Yoji Akao (1997) who firstly developed this concept, QFD was born in in the late 1960s and early 1970s 's environment as a method or concept for new product development under the umbrella of Total Quality Control. This study further develops an idea combining Kano Model with QFD in helping to build the first matrix in the House of Quality which will be together with other elements for forming a complete building of House of Quality. The main element of QFD is called "House of Quality" named by the specific shape of the diagram. The concept of House of Quality was originated from "the quality chart" that was created and made public by the Kobe Shipyards of Mitsubishi Heavy Industry (Yoji, 1997). In the context of this study, "WHATs" refer to in-flight customer requirements (CR_i), and "HOWs" refer to in-flight service capabilities (SC_j). Additionally, the DEMETEL is a comprehensive method to construct and analyze a structural model, providing the causal relationships between complicated criteria (Wu and Lee, 2007), and creating the correlations between criteria to build network relationship map (NRM) (Tzeng et al., 2007). In this study, DEMATEL method are deployed to analyze the correlation between SC_j as the roof of the house.

3. Methods

We divided the research methodology into sequential steps as follows: six computation phrases for customer requirements scores, house of quality and relationship matrix development.

3.1 Phrase I: Identifying related in-flight service requirements

We searched the widely accepted academic database SCOPUS using relevant keywords such as "airline service quality," "in-flight service quality," and "in-flight customer requirements." The search is limited to articles published between 2018 and 2024. Through related literatures along with Ethnography method, sixteen in-flight service requirements are identified which are presented in Tables 3. Along with attributes gathered from literatures, Ethnography is employed to identify related in-flight service requirement by observing customer requirements in the actual situation.

3.2 Phrase II: Validating in-flight service requirements

Content Validity Ratio (CVR) is employed to validate the in-flight service requirements gathered from Ethnography and literatures for developing the research questionnaire. The six selected qualified experts are asked to indicate which are significantly 'necessary' to enhance in-flight customer experience in term of service quality. If not, they are asked to indicate whether the attributes are 'useful but not necessary' or 'unnecessary'. Table 4 shows the results of validity confirmation for in-flight service requirements. The minimum acceptable CVR value is determined as follow:

$$\mathrm{CVR} = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \qquad \text{(Equation 1)}$$

where, N is the total number of experts, and n_e is the number of experts that provide their opinions as "necessary".

3.3 Phrase III: Determining satisfied in-flight service requirements

Kano questionnaires, which are intendedly developed for 368 airline passengers to determine satisfied in-flight service requirements. The airline passengers who have experiences flying with full-service airline are asked to indicate their feeling towards each providing service requirements. The results from functional and dysfunctional question pairs (QAs) of Kano questionnaires indicate an individual customer's perception that can be classified through Kano's evaluation table and computed through the customer satisfaction (CS) coefficient.

$$\text{ED} = -\frac{M_i+O_i}{A_i+O_i+M_i+I_i} \quad \text{(Equation 2)}$$

$$\text{ES} = \frac{A_i+O_i}{A_i+O_i+M_i+I_i} \quad \text{(Equation 3)}$$

Based on the ED and ES, Customer Satisfaction Index (CSI) are calculated as the below Equation 4

$$\text{CSI} = -\frac{Dissatisfaction}{Satisfaction} \quad \text{(Equation 4)}$$

3.4 Phrase IV: Obtaining weights of satisfied in-flight service requirements

Weights of satisfied in-flight service requirements (CRWs) are obtained by employing Kano analysis. The converted data is computed from the gap between customer satisfaction and dissatisfaction as shown in Equation 5 and Equation 8.

$$d_i^+ = \frac{A_i+O_i-R_i}{A_i+O_i+M_i+I_j+R_i} \quad \text{(Equation 5)}$$

$$d_i^- = -\frac{M_i+O_i-R_i}{A_i+O_i+M_i+I_i+R_i} \quad \text{(Equation 6)}$$

$$G_i = d_i^+ - d_i^- \quad \text{(Equation 7)}$$

$$CRW_i = \frac{G_i}{\sum_i G} \quad \text{(Equation 8)}$$

3.5 Phrase V: Identifying Significant In-Flight Service Capabilities

The six selected qualified experts are in-dept interviewed to identify in-flight service capabilities from service providers' point of view. At the end of the interview, the most significant capabilities that can meet customer requirements and enhance in-flight service quality are identified and validated.

3.6 Phrase VI: Prioritizing in-flight service capabilities

QFD and DEMATEL method are deployed to analyze the relationship between CR_i and SC_j. Significant in-flight service capabilities gathered from six qualified experts are prioritized in House of Quality to indicate their important ranks. HOQ is constructed by placing CR_i and their relative weights in rows and SC_j in columns. The roof of the house illustrates the correlation between SC_j. The calculation steps are demonstrated as follows:

3.6.1 Developing the relationship matrix between CR_i and SC_j

The relationship matrix between CR_i and SC_j is developed. The results from phrse IV is integrated with in-flight service capabilities to develop the relationship matrix. The experts are required to evaluate the degree of relationship by indicating VL, L, M, H and VH. The integer scale is used to range from 1 (no relationship) to 5 (very high relationship) In each element of the relationship matrix represents the degree of impact of each SC_j implementation on each CR_i defined as Lij. The initial score of each SC_j is defines as ISC_j that can be computed using Equation 9. The computing results of initial scores are presented in table.

$$ISC_j = \sum_{i=1}^{m} w_i \otimes L_{ij.} \quad \text{(Equation 9)}$$

Where, w_i is the relative importance weight of CR_i obtained from Kano analysis, i = 1,2, …, m, and j = 1,2, …, n.

3.6.2 Developing the correlation between SC_j by DEMATEL

DEMATEL method is deployed to evaluate the degree of relationship between in-flight service capabilities (SC_j). The experts are required to evaluate the degree of relationship between SC_j by indicating VI, HI, MI, LI, and NI. The integer scale is used to range from "VI" (5), "HI" (4), "MI" (3), "LI", and "NI" (1). The correlation between SC_j can be defined as T_{jj}. When the element i has an effect and influence on the element j, it is denoted by d_{ij}. Thus the matrix $D = [d_{ij}]_{mxm}$ of direct relationships is obtained. An average matrix D is derived by mean of the same elements in the different direct matrices of the respondents. The average matrix D is shown as Equation 10.

$$D = \begin{bmatrix} d_{11} \cdots & d_{1j} \cdots & d_{1m} \\ \vdots & \vdots & \vdots \\ d_{i1} \cdots & d_{ij} \cdots & d_{im} \\ \vdots & \vdots & \vdots \\ d_{m1} \cdots & d_{mj} \cdots & d_{mm} \end{bmatrix} \quad \text{(Equation 10)}$$

3.6.3 Calculating the influence matrix

The steps to analyze and calculate the influence matrix are as follows:

Step 1: Calculate the initial influence matrix by scores

The initial influence matrix X (i.e. $X = [X_{ij}]_{mxm}$) is derived by normalizing the average matrix D or by Equations (11)-(12), where all principal diagonal criteria equal to zero.

$$X = s * D \quad \text{(Equation 11)}$$

$$S = \min\left[\frac{1}{\max_i \sum_{j=1}^{m}|d_{ij}|}, \frac{1}{\max_j \sum_{i=1}^{m}|d_{ij}|}\right] \quad \text{(Equation 12)}$$

; where i, j ∈ {1, 2,…, m}

Step 2: Derive the total influence matrix T

A continuous decrease of the indirect effects of problems along the powers of X e.g. $X^2, X^3, \ldots, X^k$ and $\lim_{k\to\infty} X^k = [0]_{nxn}$, where $X = [X_{ij}]_{nxn}$, $0 \leq X_{ij} < 1$, $0 < \sum_i X_{ij} \leq 1$, and $0 < \sum_j X_{ij} \leq 1$, and at least one column summation $\sum_j X_{ij}$ or one row summation $\sum_i X_{ij}$ equals one.Total influence matrix T is denoted by Equation 13, where I is the identity matrix.

$$\begin{aligned} T &= X + X^2 + \ldots X^k \\ &= X (I+X+X^2+\ldots X^{k-1})(I-X)(I-X)^{-1} \\ &= X (I-X^k)(I-X)^{-1} \\ &= X (I-X)^{-1} \\ &= [0]_{mxm} \text{, when } \lim_{k\to\infty} X^k \end{aligned} \quad \text{(Equation 13)}$$

, where $T = [t_{ij}]_{mxm}$, for $i, j = 1, 2, \ldots m$ and $(I-X)(I-X)^{-1} = I$. the sum of rows and the sum of columns are separately defined and represented as vector r and c by Equation 14 - Equation 15.

$$r = (r_i)_{mx1} = [\textstyle\sum_{j=1}^{n} t_{ij}]_{mx1} \quad \text{(Equation 14)}$$

$$c = (c_j)_{1x\,m} = (c_j)'_{1xm} = [\textstyle\sum_{i=1}^{n} t_{ij}]'_{1xm} \quad \text{(Equation 15)}$$

Step 3: Obtain the absolute importance weights of SC_j integrating DEMATEL

The absolute importance score of each SCj defined as ASC_j are obtained by considering the correlations between in-flight service capabilities using Equation 16.

$$ASC_j = ISC_j \oplus \textstyle\sum_{j\neq j} T_{jj} \otimes ISC_{jj.} \quad \text{(Equation 16)}$$

, where ISC_j represents the initial scores of in-flight service capabilities, T_{jj} represents correlation between in-flight service capabilities.

Step 4: Ranking the SC_j

The absolute importance weights of in-flight service capabilities (ASC_j) are ranked in descending order according the absolute importance scores.

4. Data Collection

4.1 Sample and Data gathering

For quantitative method involving primary data collection, passengers who have experienced in-flight services from both Airbus and Boeing fleet will be the sample size of the research project as perception of perceiving service quality tends to be different in term of cabin configuration, cabin seat, cabin ambient, engine noise and gally. In the context of this study, data are collected using an online questionnaire survey through Google Forms from March to May 2024. The sample size is calculated using Equation 17 (Taro Yamane, 1967).

$$n = \frac{\mathrm{N}}{1+\mathrm{N}/\mathrm{e}^2},\ n = \frac{4638}{1+4638/(0.05)^2} = 368 \qquad \text{(Equation 17)}$$

4.2 Qualified experts

In this study, Cabin senior directors and Cabin seniors are the research' six qualified experts. The criteria for the experts are that they have to be in charge for all cabins; first class, business class and economy class with their in-flight responsibilities as delivering an excellent hospitality, services, products and experience at every touchpoint. Each of these experts brings extensive knowledge and over 10 years of experience in airline service industry within in-flight services sector. They are both validators and participants of the research projects. Firstly, they involve in validating the attributes for developing questionnaire customer survey. Second, they involve in providing technical requirements to improve service performance from service provider's point of view.

4.3 Questionnaire development

We develop three questionnaires in this study. The first questionnaire is intendedly developed for six qualified experts to validate the in-flight service requirements gathered from literatures and Ethnographic method. The second questionnaire is developed from Kano's questionnaire pattern after the validation to determine the satisfaction. Lastly, based on the determined and validated in-flight service capabilities from service providers' point of view, the third questionnaire is developed through the house of quality of QFD. The six qualified experts are asked to indicate the degree and influential level of the relationship in order to prioritize the relationship between in-flight customer requirements and service capabilities and the internal relationship between each capabilities.

5. Results and Discussion

5.1 Results

Phrase I: Identifying related in-flight service requirements

Twelve in-flight service requirements by literatures and employing Ethnographic method are identified in Table 1.

Table 1. Related in-flight service requirements

Code	In-flight service requirements	Description	Reference
R_1	Cleaned and disinfected aircraft	The aircraft is carefully cleaned and disinfected before and after the flight	Zahraee et al., (2023), Amankwah-Amoah (2021)
R_2	Cabin cleanliness and hygiene	Cabin cleanliness and hygiene is maintained throughout the flight e.g., cleanliness of seat, lavatory, aisle, service cart, gally	N.M. Suki (2014), Customer feedback/observing
R_3	Cabin air quality	Cabin air is filtered and purified by HEPA filter to enhance cabin air quality of the entire aircraft	Zahraee et al., (2023), Bielecki et al., (2022)
R_4	Trained Cabin crew	Cabin crew are trained in all the measures relevant to their role that are required to mitigate infection risk (including PPE use, personal hygiene, physical distancing, new procedures, awareness of symptoms and risk factors)	Customer feedback/observing
R_5	Quality of in-flight meals and beverage	In-flight meals are delivered on time with high quality and quantity e.g., choices of menu, selections of beverage	Gilbert & Wong (2003) Customer feedback/observing
R_6	Hospitality and service-minded	Cabin crew delivers in-flight service with hospitality and service-minded	Pakdil and Aydın (2007)
R_7	Well-groomed cabin crew	Cabin crew is well-groomed and maintain hygienic throughout the flight	Customer feedback/observing
R_8	Efforts and comfort	Cabin crew make their best efforts to ensure that passengers are comfortable while seated-sitting	Gilbert and Wong (2003), Pakdil and Aydın (2007)
R_9	Well-designed aircraft	Cabin interior is well-designed to maximize customer’ s physical comfort e.g., cabin ambient light, configuration of seat, numbers of lavatory and space for luggage storage	Customer feedback/observing
R_{10}	Ergonomic seats	Seats are ergonomically designed to support customer’s neck, back, pelvis and muscle while seated e.g., seat cushion design, extra leg room, extra-reclined seat back and seat space	Customer feedback/observing
R_{11}	Complimentary high-speed WIFI	Onboard Wi-Fi service is being offered with Hi-speed connectivity, stable and no extra charge throughout the flight	Customer feedback/observing
R_{12}	Touchless in-flight entertainment and facilities	Touchless in-flight entertainment and facilities are available for contactless passenger journey e.g., personalized wireless entertainment, Bluetooth, NFC, faucet and toilet sensor	Michelmann et al., (2023)

Phrase II: Validating in-flight service requirements

In section 3.2, we present a group of experts, who are invited to validate in-flight service requirements for use in this study. The CVR can be calculated using Equation 1. Those with CVR value ≥ 0.33 is accepted, otherwise it will be rejected. Table 2 shows the results of validity confirmation that all twelve requirements are accepted and suitable to be used in this study.

Table 2. The results of CVR

Code (s)	In-flight service requirements	n_e	CVR	Judgement
R_1	Cleaned and disinfected aircraft	5	0.67	Accepted
R_2	Cabin cleanliness and hygiene	6	1	Accepted
R_3	Cabin air quality	4	0.33	Accepted
R_4	Trained Cabin crew	4	0.33	Accepted
R_5	Quality of in-flight meals and beverage	5	0.67	Accepted
R_6	Hospitality and service-minded	6	1	Accepted
R_7	Well-groomed cabin crew	5	0.67	Accepted
R_8	Efforts and comfort	6	1	Accepted
R_9	Well-designed aircraft	5	0.67	Accepted
R_{10}	Ergonomic seats	4	0.33	Accepted
R_{11}	Complimentary high-speed WIFI	5	0.67	Accepted
R_{12}	Touchless in-flight entertainment and facilities	4	0.33	Accepted

Phrase III: Determining satisfied in-flight service requirements

According to the results from 368 respondents, the gathered customer survey questionnaires are analyzed based on Kano model procedures in Section 2 and 3. Customer satisfaction index (CSI) can be obtained by using Equation 4. The calculation of the extent of satisfaction using Equation 3 and extent of dissatisfaction using Equation 2 determines the level of customer satisfaction and dissatisfaction with each customer requirements (Table 3).

Table 3. Determination of satisfied in-flight service requirements

Code(s)	A	O	M	I	R	Q	A+O	O+M	A+O+M+I	ED	ES	CSI
R_1	33	88	207	20	20	0	121	295	348	-0.848	0.343	2.475
R_2	232	109	22	2	3	0	341	131	365	-0.359	0.929	0.386
R_3	182	70	52	63	1	0	252	122	367	-0.332	0.685	0.485
R_4	60	79	53	176	0	0	139	132	368	-0.359	0.378	0.950
R_5	133	62	149	17	7	0	195	211	361	-0.584	0.533	1.096
R_6	223	97	29	19	0	0	320	126	368	-0.342	0.870	0.394
R_7	60	128	51	125	4	0	188	179	364	-0.492	0.515	0.955
R_8	227	50	62	26	3	0	277	112	365	-0.307	0.754	0.407
R_9	89	120	40	112	7	0	209	160	361	-0.443	0.574	0.772
R_{10}	171	74	53	68	2	0	245	127	366	-0.347	0.667	0.520
R_{11}	214	65	67	20	2	0	279	132	366	-0.361	0.759	0.475
R_{12}	70	115	2	179	2	0	185	117	366	-0.320	0.504	0.634

Phrase IV: Obtaining weights of satisfied in-flight service requirements

The weight of each in-flight service requirements (w_i) is computed from the gap between satisfaction and dissatisfaction (Table 4). Each CRW_i with its rank is obtained by using Equation 8 as shown in Table 4, with R_2 rated the highest rank (0.104) followed by R_6 (0.099), R_{11} (0.091), R_5 (0.087), R_8 (0.085), R_1 (0.084), R_3 (0.083), R_{10} (0.082), R_7 (0.080), R_9 (0.079), R_{12} (0.066) and R_4 (0.060)

Table 4. Relative important weights of customer satisfaction

Code(s)	In-flight customer requirements (CR)	Category	CRW	Rank
R_1	Cleaned and disinfected aircraft	M	0.084	6
R_2	Cabin cleanliness and hygiene	A	0.104	1
R_3	Cabin air quality	O	0.083	7
R_4	Trained Cabin crew	I	0.060	12
R_5	Quality of in-flight meals and beverage	M	0.087	4
R_6	Hospitality and service-minded	A	0.099	2
R_7	Well-groomed cabin crew	O	0.080	9
R_8	Efforts and comfort	A	0.085	5
R_9	Well-designed aircraft	O	0.079	10
R_{10}	Ergonomic seats	A	0.082	8
R_{11}	Complimentary high-speed WIFI onboard	A	0.091	3
R_{12}	Touchless in-flight entertainment and facilities	O	0.066	11

Phrase V: Identifying significant in-flight service capabilities

Nine significant in-flight service capabilities (SC) by mean of an in-dept interview are identified in Table 5.

Table 5. Significant in-flight service capabilities

Code	In-flight service capabilities	Description
C_1	Mitigation of cabin crew's cabin and service tasks	Cabin and service tasks such as gally works, service cart handling are mitigating to manage high workload and work-related musculoskeletal discomfort
C_2	Weight limited of carry-on baggage	Carry-on baggage is limited in term of weight and size to avoid in-flight accidents and minimize cabin crew's work-related musculoskeletal discomfort
C_3	Positive working environment	Cabin crew is having good teamwork and positive working environment on that flight
C_4	Sufficient after-flight rest for physical recovering	After-flight rest is sufficient before next duty for physical recovering; from standing, walking, reaching, lifting, pushing, pulling trolleys
C_5	Sufficient after-flight rest for psychological recovering	After-flight rest is sufficient before next duty for psychological recovering; from irregular work hours, lacking of oxygen and working in confined space
C_6	Appropriate monthly flight pattern	Monthly flight pattern is given by considering irregular work hours to minimize disturbance of body rhythm or being jet lag
C_7	Sufficient knowledge for fatigue management	Cabin crew have sufficient knowledge for fatigue management to achieve work-life balance
C_8	Physical health and psychological treatment	Company considers cabin crew physical health and psychological treatment as significant after flight duty
C_9	Comfortable aircraft facilities	The aircraft is equipped with facility features that make it more comfortable to work with

Phrase VI: Prioritizing in-flight service capabilities

Step 1: Developing the relationship matrix between CR_i and SC_j (L_{ij})

The relationship matrix between CR_i *and* SC_j denoted as L_{ij} is developed by utilizing the relative weights (w_i) of each CR_i with the degree of relationship between CR_i *and* SC_j. The result of each element of the relation matrix (L_{ij}) are presented in Table 6.

Table 6. Computation result of each element of relation matrix (L_{ij})

CR_i	CRW (w_i)	SC_j								
		C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
R_1	0.084	0.098	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.294
R_2	0.104	0.364	0.139	0.364	0.243	0.104	0.173	0.121	0.156	0.381
R_3	0.083	0.083	0.083	0.249	0.097	0.401	0.083	0.208	0.083	0.415
R_4	0.060	0.070	0.060	0.080	0.130	0.110	0.060	0.100	0.230	0.220
R_5	0.087	0.406	0.087	0.377	0.334	0.276	0.392	0.290	0.348	0.232
R_6	0.099	0.429	0.314	0.495	0.380	0.429	0.314	0.330	0.446	0.264
R_7	0.080	0.320	0.120	0.347	0.400	0.333	0.240	0.187	0.267	0.213
R_8	0.085	0.397	0.241	0.425	0.340	0.269	0.340	0.255	0.354	0.269
R_9	0.079	0.263	0.211	0.329	0.119	0.079	0.079	0.079	0.079	0.356
R_{10}	0.082	0.219	0.082	0.191	0.123	0.082	0.082	0.082	0.082	0.301
R_{11}	0.091	0.091	0.091	0.212	0.137	0.091	0.091	0.091	0.091	0.394
R_{12}	0.066	0.066	0.066	0.143	0.099	0.066	0.066	0.066	0.066	0.330

Step 2: Developing the correlation between SC_j by DEMATEL

A group of experts defined the influence relationship among in-flight service capabilities based on pair wise comparison, denoted as T_{jj}. The average initial direct-relation 9×9 matrix *D* is obtained by Equation 10 as shown in Table 7.

Table 7. The influence relationship among in-flight service capabilities (T_{jj})

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
C_1	0.000	3.667	2.500	0.833	0.500	1.167	1.667	2.333	3.333
C_2	3.500	0.000	3.500	1.000	0.000	0.000	0.833	1.167	0.500
C_3	3.667	1.833	0.000	0.500	0.000	0.167	0.167	0.333	3.167
C_4	1.833	1.667	1.000	0.000	3.333	3.333	2.500	3.500	0.833
C_5	0.500	0.333	0.500	1.500	0.000	3.167	2.333	3.667	0.667
C_6	0.500	0.167	0.167	2.000	2.500	0.000	3.000	3.667	0.333
C_7	0.333	0.333	1.000	2.333	2.000	1.833	0.000	3.167	0.333
C_8	0.500	0.167	0.333	3.500	3.500	3.667	2.500	0.000	0.333
C_9	1.167	1.000	3.500	0.000	0.000	0.000	0.000	0.000	0.000

Step 3: Obtain weights of SC_j integrating DEMATEL

Based on section 3.6.3, the results of the absolute importance scores of each in-flight service capabilities by integrating DEMATEL, denoted as ASC_j are shown as Table 8.

Table 8. The absolute importance weights of SC_j integrating DEMATEL

CR_i	CRW (w_i)	0.113	0.084	0.088	0.140	0.119	0.125	0.117	0.150	0.064
		C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
R_1	0.084	0.098	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.294
R_2	0.104	0.364	0.139	0.364	0.243	0.104	0.173	0.121	0.156	0.381
R_3	0.083	0.083	0.083	0.249	0.097	0.401	0.083	0.208	0.083	0.415
R_4	0.060	0.070	0.060	0.080	0.130	0.110	0.060	0.100	0.230	0.220
R_5	0.087	0.406	0.087	0.377	0.334	0.276	0.392	0.290	0.348	0.232
R_6	0.099	0.429	0.314	0.495	0.380	0.429	0.314	0.330	0.446	0.264
R_7	0.080	0.320	0.120	0.347	0.400	0.333	0.240	0.187	0.267	0.213
R_8	0.085	0.397	0.241	0.425	0.340	0.269	0.340	0.255	0.354	0.269
R_9	0.079	0.263	0.211	0.329	0.119	0.079	0.079	0.079	0.079	0.356
R_{10}	0.082	0.219	0.082	0.191	0.123	0.082	0.082	0.082	0.082	0.301
R_{11}	0.091	0.091	0.091	0.212	0.137	0.091	0.091	0.091	0.091	0.394
R_{12}	0.066	0.066	0.066	0.143	0.099	0.066	0.066	0.066	0.066	0.330
SC_j initial scores		2.806	1.577	3.297	2.484	2.324	2.003	1.893	2.285	3.670
ASC_j		4.279	2.184	3.848	4.529	3.762	3.442	3.110	3.724	3.961
		0.130	0.067	0.117	0.138	0.115	0.105	0.095	0.113	0.121

Step 3.4: Rank the SC_j

The In-flight service capabilities are prioritized in descending order based on their respective ASC_j, as C_4 rated the highest rank (0.138) followed by C_1 (0.130), C_9 (0.091), C_3 (0.117), C_5 (0.115), C_8 (0.113), C_6 (0.105), C_7 (0.095), C_2 (0.067) as shown in Table 8.

5.2 Discussion

From the customer's point of view, the three most importance of in-flight customer requirements are "cabin cleanliness and hygiene" (R2), "cabin crew' s hospitality and service-minded" (R6), and "complimentary high-speed Wi-Fi onboard" (R11), with implicit importance scores of 0.104, 0.099, and 0.091, respectively (see Table 6). This implies that customers nowadays have high expectations for health and safety hygiene including convenience and up-to-date aircraft technology. The results of the research affirm that accessible services and staff services are core services with their findings emphasizing customer requirements involving personalized customer experience and cabin crew aspect are still important no matter how changes the environment are. The result also implies that expectations for health and safety hygiene have become in-flight concern due to the awareness of the unpreceded pandemic. Attitudes towards hygiene, cleaning efforts and health-protective behaviors are trends of passenger requirement for the future aviation along with innovative technologies and convenience. Convenience and technology such as in-flight Wi-Fi connection have become in-flight concern due to global digitalization. This finding implies a digitalized end-to-end customer experience, from booking, ground services for check-in and boarding, in-flight services and baggage handling. Using technology to deliver value to airline customer at every stage of the customer experience enables the airline to improve an ability to provide more meaningful interactions with customers, at times with a more touchless and contactless experience in-flight. Accordingly, the results of prioritized relationship integrating between in-flight customer requirements and in-flight service capabilities show that the three most importance of in-flight service capabilities are "sufficient after-flight rest for physical recovering" (C4), and "Mitigation of cabin crew's cabin and service tasks" (C1), "comfortable aircraft facilities" (C9), with implicit importance scores of 0.138, 0.130, and 0.121, respectively (see Table 8). This implies that cabin crew, who perform a multitude of tasks to ensure customer comfort, emergency response and safety procedures including in-flight services throughout customer journey, requires a sufficient rest, manageable workload and comfortable aircraft environment to maintain and improve their in-flight performance required by customers. To achieve an exceptional customer experience and empower sustainable service quality, cabin crew's satisfaction, feeling and positive attitude are also significant in delivering their performance. Thus, the key finding of this study seeks first to understand customer and also aims to understand service providers to enhance customer experience.

6. Conclusion

This study proposes Ethnography with an integrated Kano and QFD to analyze customer satisfaction in airline service quality. The findings of this study provide several managerial implications and make a valuable contribution for improving in-flight service quality. Through a comprehensive literature analysis and Ethnography method, 12 in-flight customer requirements are identified. CVR enables the six qualified experts to validate the in-flight customer requirements and service capabilities for questionnaire development. Kano questionnaires are developed for 368 airline passengers to determine the satisfaction. QFD with DEMATEL method to translate customer requirements into technical requirements. Significant in-flight service capabilities gathered and validated from six qualified experts by in-dept interview are prioritized in house of quality to indicate their important ranks for service enhancement. The results of this study reveal that Cabin cleanliness and hygiene" is the most important attribute required by customer when travelling onboard. This is given the first priority to airline representatives to pay attention to hygiene and cleanliness in order to enhance their in-flight service quality. The second most important barriers are "cabin crew' s hospitality and service-minded". cabin crew, who are the frontline representatives of the airline, are responsible for delivering an exceptional customer experience while prioritizing customer safety and security. Therefore, their hospitality and service-minded contribute to significantly to overall customer travel experience. The third most important is and "complimentary high-speed Wi-Fi onboard". This indicates the necessary for network and technology implementation in the aircraft. Additionally, from service providers' point of view, the result shows that a sufficient rest, manageable workload and comfortable aircraft environment are the most important capabilities of cabin crew to perform their in-flight service tasks. In conclusion, this study significantly contributes to the field of airline service quality by enhancing the airline' strategies to retain customers and strengthen relationships with dedication and application for an aviation resilience. In the realm of future research, this study suggests that it would be interesting to enhance over all airline service quality. Future research should discover the examination of service quality starting from ground services to enhance customer experience.

Reference

Abdel Rady, H., Measuring airline service quality using AIRQUAL model: A study applied to Egypt air. *International Journal of Heritage, Tourism and Hospitality*, vol. 12, no. 1, pp. 271-290, 2018.

Akao, Y., QFD: Past, present, and future. *In International symposium on QFD*, vol. 97, no. 2, pp. 1-12, 1997.

Amankwah-Amoah, J., COVID-19 pandemic and innovation activities in the global airline industry: A review. *Environment International*, vol. 156, 2021.

Badrillah, M. I. M., Shuib, A. and Nasir, S., How airline service quality (AIRQUAL) affects customer decision making in airline choices—A conceptual paper. *In International Conference on Business and Technology*. pp. 201-215, 2021.

Basfirinci, C. and Mitra, A., A cross cultural investigation of airlines service quality through integration of Servqual and the Kano model. *Journal of Air Transport Management,* vol. 42, pp. 239-248, 2015.

Çallı, L. and Çallı, F., Understanding airline passengers during covid-19 outbreak to improve service quality: topic modeling approach to complaints with latent dirichlet allocation algorithm. *Transportation Research Record*, vol. 2677, no. 4, pp. 656-673, 2023.

Dike, S.E., Davis, Z., Abrahams, A., Anjomshoae, A. and Ractham, P., Evaluation of passengers' expectations and satisfaction in the airline industry: an empirical performance analysis of online reviews, *Benchmarking: An International Journal*, vol. 31, no. 2, pp. 611-639, 2024.

Gupta, H., Evaluating service quality of airline industry using hybrid best worst method and VIKOR. *Journal of Air Transport Management*, vol. 68, pp. 35-47, 2018.

Hsu, Y. L., Hsu, C. C. and Bing, P. C., Capturing passengers' voices: the application of Kano's model in the airline industry. *In International Conference on Logistics, Shipping and Port Management*, vol. 28, pp. 1-14. 2007.

Hussain, R., Al Nasser, A. and Hussain, Y. K., Service quality and customer satisfaction of a UAE-based airline: An empirical investigation. *Journal of Air Transport Management*, vol. 42, pp. 167-175, 2015.

Jarrett, J. E., Pan, X., Yang, Y., Huang, Y., Huang, L. and Li, F., Combining SERVQUAL and QFD to evaluate and improve airline service quality, 2019.

Jiaokun, C. A. O. and Shuiting, D. I. N. G., Sensitivity analysis for safety design verification of general aviation reciprocating aircraft engine. *Chinese Journal of Aeronautics*, vol. 25, no. 5, pp. 675-680, 2012.

Kim, D., Lim, C. and Ha, H. K., Comparative analysis of changes in passenger's perception for airline companies' service quality before and during COVID-19 using topic modeling. *Journal of Air Transport Management*, vol. 115, 2024.

Leon, S. and Dixon, S., Airline satisfaction and loyalty: Assessing the influence of personality, trust and service quality. *Journal of Air Transport Management*, vol. 113, 2023.

Lopez-Valpuesta, L. and Casas-Albala, D., Has passenger satisfaction at airports changed with the onset of COVID-19? The case of Seville Airport (Spain). *Journal of Air Transport Management*, vol. 108, 2023.

Park, S., Lee, J. S. and Nicolau, J. L., Understanding the dynamics of the quality of airline service attributes: Satisfiers and dissatisfiers. *Tourism Management*, vol. 81, 2020.

Park, J. W., Robertson, R. and Wu, C. L., The effect of airline service quality on passengers' behavioral intentions: a Korean case study. *Journal of Air Transport Management*, vol. 10, no. 6, pp. 435-439, 2004.

Percin, S., Evaluating airline service quality using a combined fuzzy decision-making approach. *Journal of Air Transport management*, vol. 68. pp. 48-60, 2018.

Pereira, F., Costa, J. M., Ramos, R. and Raimundo, A., The impact of the COVID-19 pandemic on airlines' passenger satisfaction. *Journal of Air Transport Management*, vol. 112, 2023.

Rahman, S. M. A., Ethnographic Study in Air Travel Research. *In Air Travel Industry*, pp. 111-127, 2023.

Salleh, R. M., Customer Satisfaction Analysis Using Quality Function Deployment: A Case Study on Malaysian Domestic Airlines. Enhanced Knowledge in Sciences and Technology, vol. 2, no. 1, pp. 056-068, 2022.

Sharma, H. L. and Sarkar, C., Ethnography research: An overview. *International Journal of Advance and Innovative Research*, vol. 6, no. 2, pp. 1-5, 2019.

Suki, N. M., Passenger satisfaction with airline service quality in Malaysia: A structural equation modeling approach. *Research in transportation business & management*, vol. 10, pp. 26-32, 2014.

Sun, X., Zheng, C., Wandelt, S. and Zhang, A., Airline competition: A comprehensive review of recent research. *Journal of the Air Transport Research Society*, 2024.

Todorov, V. T., Rakov, D. and Bardenhagen, A., Sensitivity Analysis and System Attribute Importance for Conceptual Aircraft Design with the Advanced Morphological Approach. *Aerospace*, vol.10, no.7, pp.608, 2023.

Zahraee, S. M., Shiwakoti, N., Jiang, H., Qi, Z., He, Y., Guo, T. and Li, Y., A study on airlines' responses and customer satisfaction during the COVID-19 pandemic. *International Journal of Transportation Science and Technology*, vol. 12, no. 4, pp.1017-1037, 2023.