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I-Valued Neutrosophic AHP:An Application To Assess Airline Service Quality After Covid-19 Pandemy

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Abstract. This study proposes the I-valued Neutrosophic AHP technique to evaluate airline service quality by determining importance priorities for passengers and generating recommendations to managers to allocate the most appropriate resource for increasing service quality and customer satisfaction. We also provide a list of what airline managers need to improve in resource allocation to increase service quality by taking customer satisfaction into account. This technique can be adapted for any industry where service quality depends on multiple attributes.

Keywords: Interval valued neutrosophic AHP; Euclidean tangent combine similarity; airline ; Covid 19 pandemy; hygiene, pandemy.

1. Introduction

More than 209 countries that are desperate in the face of COVID-19, which first appeared in December 2019, have been struggling against the pandemic by focusing on the social distance and hygiene rules proposed by the World Health Organization (WHO), Boopathi et al. ([4]). Especially, after infected airline passengers spread Covid 19 to different regions and turning it into a pandemic, the vast majority of countries have taken measures in order to restrict international human mobility, such as closing their borders to international traffic, imposing visa restrictions or putting in quarantines to their citizens coming from abroad Chung, ([11]); Liu et al. ([25]). The number of passengers who prefer air transportation today has decreased by 80Air Transport Association (2020). The Airlines sector has become one of the service sectors which suffered the most damage from Covid-19 with their parked airplanes. However, the sectors such as trade, business and tourism are dependent upon airline transport since the

basis of air travel consists of the concept of traveling quickly and safely to long distances. The new priorities and concerns that the Covid-19 pandemic induced will unquestionably cause to remarkable changes on the criteria of airline service quality Cao et al., ([6]). In the concerning literature, the only study exercised in point of this subject is the study that measures the preventive expectations of the passengers with regard to the airline service quality by using IPA after the influenza pandemic of novel swine Chou and Lu, ([10]). However, the studies emphasized the importance of the measures to be taken in airplanes and during flight, while it has been determined that their passengers pay attention to pandemic and they do not want to catch this pandemic Chou, ([9]; Khan et al., ([22]).

In some MCDM problems, situations where the degree of membership values are not a real numerical value but instead they are an interval. The service quality is also a combination of various properties in this sense, it contains many indefinite properties and it is difficult to measure with classical MCDM techniques. Fuzzy Sets (FS) and IVFSs have been used in various studies in order to eliminate this deficiency. However, the relationships are defined by membership degrees in fuzzy sets and they dont contain non-membership degree values (they dont contain non-membership degree values). Intuitionistic fuzzy sets are sets whose elements have degrees of membership and non-membership. (Intuitionistic fuzzy sets are sets whose elements have degrees of membership and non-membership). The totals of membership and non-membership values are 1 or less than 1 in this place. In fact, the components regarding the assesstments of the answerers are independent from each other, especially in the studies of service quality, where there is no complete information and mixed, ambiguous, close expectations and perceptions are observed.

Neutrosophic sets developed by Smarandache ([32]) approached these deficiencies of intuitionistic fuzzy sets (IFS's) with regard to uncertainty, impreciseness, inconsistency and vagueness from a different perspective. Its degree of indeterminacy/neutrality component was included in fuzzy sets and defined as three components.. Thus, it gives a more capable description of the indeterminacy parameter membership functions. In addition, since component membership degree and non-membership degree are not interconnect, the necessity of the total of membership function elements to be equal to for a certain event 1 is eliminated. There are just a few neutrosophic AHP papers containing applications. Namely, Radwan et al. ([31]) worked on a hybrid neutrosophic AHP approach in learning management systems and Abdel-Basset et al. ([1]). introduced the integration of AHP into Delphi under neutrosophic framework. The study by Bolturk et al. ([4]) used the interval valued neutrosophic AHP with the deneutrosophication method together with the cosine similarity measure.

On the other hand, most of the researchers concern in comparing two or more MCDM methodologies and analyzing the advantages or drawbacks of each method in the literature. However,

what needs to be examined is the validity, reliability and / or consistency of the result that is analyzed and decided. The sensitivity analyzes do not reflect the reality or sensitivity results with different analyzes give different results most of the time. This study is almost the first work to determine the service quality attributes that the passengers will place emphasis on after pandemic. The method of the research gives better results than traditional approaches. Moreover, analyzes with regard to the validity, reliability and / or consistency of the results are applied for the first time in the concening literature. This study has a distinctive added value for all these reasons.

2. Service quality in the airline transportation industry in the light of pandemic issues

The issues such as fast diagnosing of sick passengers, implementation of isolation and quarantine applications in time constitute another dimension of airline service quality since passengers can spread contagious diseases to more distant regions by connection flights between countries on air travel (Nikolaou and Dimitriou, [29]). These factors of service quality, on one hand, relate to reducing the risk of pandemic to passengers, on the other hand, they associate with the crew, airline company managers, and also other passengers having responsible attitude pertinent to the pandemic (Baker et al., [**?**]).

Studies with regard to the airline sector concerning the pandemic are very restricted. These studies are with regard to the spread of the pandemic (Gold et al., [18]; Nikolaou and Dimitriou, [29]; Hsu and Shih, [21]; Tuncer and Le, [33]) and the economic impact of the pandemic on the sector (Chung, [12]). It has been observed that there is a single study where the priorities of service quality regarding the pandemic were assessed from a passenger perspective (Chou and Lu, [11]). While this study measures the perception of passengers in airlines against influenza (H1N1) preventive measures, (1) the cleaning of cabin and disinfection services, (2) the personal protective requirements and (3) influenza preventive equipment are determined as service quality dimensions (Chou and Lu, [11]). The directors of the sector sharing their views relating to the Covid 19 pandemic emphasize the need for social distance and hygiene measures in order to eliminate the concerns of the passengers and to make the air travel attractive.

Different airlines and airport operators try to respond to the concerns of the passengers regarding these issues by taking a variety of measures with COVID-19 pandemic. For example, the technological devices such as thermo-imaging cameras and temperature measurement equipment, filter and duct cleaning works in ventilation ducts and new hand sanitizer stations are being used in Istanbul airport (Istanbul Airport, 2020). EVA Air asks that the crew on airplanes wear sanitary masks, that the passengers collect their cafeteria trays by wearing gloves

and it distributes brochures providing information on how to prevent the spread of the virus. China Airlines ensures that all passengers wear a face mask at check-in and during flight, they are checked for temperature before boarding, table cloth, Menu card / wine list are not presented and the cabins are sterilized after each flight. Tigerair Taiwan replaces the head restraints every time after journey and also canceled the on-board duty free service by removing the magazines in the airplane (Tigerair Taiwan, 2020).

3. **Interval Valued Neutrosophic Sets Logic and arithmetic**

In 1998, Smarandache ([32]) introduced a more generalized tool to handle uncertainty, imprecise, incomplete and inconsistent information, called as Neutrosophic logic and sets. Neutrosophic set is a generalization of fuzzy set, interval valued fuzzy set, intuitionistic fuzzy set and interval valued intuitionistic fuzzy set. It is a logic, in which each proposition has a degree of truth (T), a degree of indeterminacy (I), and a degree of falsity (F). Also an element x in a Neutrosophic set (NS) X has a truth membership, an indeterminacy membership and a falsity membership, which are independent and which lies between $[0, 1]$, and sum of them is less than or equal to 3.

Definition 3.1. [34]. Consider a given set $X = \{x_1, x_2, \ldots, x_n\}$. **The Interval valued neutrosophic set** S on X is defined as follows:

$$S = \{< x_i, [T_S^L(x_i), T_S^U(x_i)], [I_S^L(x_i), I_S^U(x_i)], [F_S^L(x_i), F_S^U(x_i)] >: x_i \in X\}$$

satisfying the condition

$$0 \leq \sup T_S^U(x_i) + \sup I_S^U(x_i) + \sup F_S^U(x_i) \leq 3$$

where $[T_S^L(x_i), T_S^U(x_i)]$ represent the truth-membership function and similarly $[I_S^L(x_i), I_S^U(x_i)]$ and $[F_S^L(x_i), F_S^U(x_i)]$ are the indeterminacy-membership function and the falsity - membership function respectively.

Definition 3.2. [25]. For any two interval valued neutrosophic sets

$$N_1 = \{< x_i, [T_{N_1}^L(x_i), T_{N_1}^U(x_i)], [I_{N_1}^L(x_i), I_{N_1}^U(x_i)], [F_{N_1}^L(x_i), F_{N_1}^U(x_i)] >: x_i \in X\}$$

and

$$N_2 = \{< x_i, [T_{N_2}^L(x_i), T_{N_2}^U(x_i)], [I_{N_2}^L(x_i), I_{N_2}^U(x_i)], [F_{N_2}^L(x_i), F_{N_2}^U(x_i)] >: x_i \in X\}$$

$$\begin{aligned} N_1 \subseteq N_2 \iff & T_{N_1}^L(x_i) \leq T_{N_2}^L(x_i), T_{N_1}^U(x_i) \leq T_{N_2}^U(x_i), I_{N_1}^L(x_i) \geq I_{N_2}^L(x_i), \\ & I_{N_1}^U(x_i) \geq I_{N_2}^U(x_i),\ F_{N_1}^L(x_i) \geq F_{N_2}^L(x_i), F_{N_1}^U(x_i) \geq F_{N_2}^U(x_i) \end{aligned} \quad (1)$$

Note that if $T_S^L(x_i) = T_S^U(x_i)$; $I_S^L(x_i) = I_S^U(x_i)$ and $F_S^L(x_i) = F_S^U(x_i)$ then IVNS S is reduced to the single valued neutrosophic set S.

The purpose of deneutrosophication is to convert a neutrosophic number obtained by any Neutrosophic multi criteria decision method to a single real number, crisp number, which can be easily used for comparison. Similar to defuzzification (Klir and Yuan, [24]), there are several deneutrosophication methods according to different applications (Bolturk and Kahraman, [4]) There is no conclusion as to which of the different deneutrosophication methods in the literature is more appropriate to use. This research propose the following deneutrosophication process for IVN numbers as a modified version of the deneutrosophication definition given in the PhD Thesis of H. Wang ([34]).

Definition 3.3. (The deneutrosophication) For any interval valued neutrosophic number

$$A = \{< [T_A^L, T_A^U], [I_A^L, I_A^U], [F_A^L, F_A^U] >\}$$

the deneutrosophication of A is defined by the formula

$$D(A) = c_1.AvT_A + c_2.(1 - AvF_A) + \frac{c_3}{2}.AvI_A + c_4.(1 - \frac{1}{2}.AvI_A) \tag{2}$$

where $0 \leq c_i, i = 1, 2, 3, 4$ and $\sum_i^4 c_i = 1, c_3 \neq c_4$ with

$$AvT_A = \frac{T_A^L + T_A^U}{2},\ AvI_A = \frac{I_A^L + I_A^U}{2},\ AvF_A = \frac{F_A^L + F_A^U}{2}$$

Here the AvT_A term gives the direct information about the truth degree. For this reason it is used directly in the formula. On the other hand the AvF_A and AvI_A terms gives the indirect information about the truth-degree, so
$(1 - AvF_A)$ and $(1 - AvI_A)$ are used in the formula. The formula has to consider two potential truth values implicitly represented by I_A with different weights c_3 and c_4. In general, $c_1 > c_2 > c_3, c_4$; where c_3 and c_4 should be decided according to the available information in the numerical examples.

4. I-Valued Neutrosophic AHP Method

The I- Valued Neutrosophic with AHP and sensitivity analysis consists of 10 basic steps.

Step 1. Determine the I- valued neutrosophic scale (see Table 1).

Step 2. Write the alternatives; pre flight, in flight, post flight and criteria (social distance, (SC) ; C2: hygiene (H) and C3: corona pandemy awereness and concern (CAC))

Step 3. Collect evaluations by using a questionnaire form including pairwise comparisons of criteria and alternatives. Write it using the following proposed I- valued neutrosophic evaluation scale given in Table 1.

Table 1. Linguistic terms and neutrosophicated importance weights.

Linguistic Term	Neutrosophic Sets
Equal importance	¡[0.50,0.50], [0.50,0.50], [0,50,0.50]¿
Weakly more importance	¡[0.50,0.60], [0.35,0.45], [0.40,0.50]¿
Moderate importance	¡[0.55,0.65], [0.30,0.40], [0.35,0.45]¿
Moderately more importance	¡[0.60,0.70], [0.25,0.35], [0.30,0.40]¿
Strong importance	¡[0.65,0.75], [0.20,0.30], [0.25,0.35]¿
Strongly more importance	¡[0.70,0.80], [0.15,0.25], [0.20,0.30]¿
Very strong importance	¡[0.75,0.85], [0.10,0.20], [0.15,0.25]¿
Very strongly more importance	¡[0.80,0.90], [0.05,0.10], [0.10,0.20]¿
Extreme importance	¡[0.90,0.95], [0.00,0.05], [0.05,0.15]¿
Extremely high importance	¡[0.95,1.00], [0.00, 0.00],[0.00,0.10]¿
Absolutely more importance	¡[1.00,1.00], [0.00,0.00], [0.00,0.00]¿

Step 4. Compute the sum of the columns of the pairwise comparison matrix and obtain the normalized values.

$$\ddot{A}_{ij} =< [\sum_{k=1}^{n} T_{kj}^{L}, T_{kj}^{U}], [\sum_{k=1}^{n} I_{kj}^{L}, I_{kj}^{U}], [\sum_{k=1}^{n} F_{kj}^{L}, F_{kj}^{U}] > \quad (3)$$

Where $j = 1, 2, 3, \ldots, n$.

Step 5. Evaluate the average of elements in the rows and obtain $A\ddot{W}_{ij}$.

Step 6. Evaluate the corresponding crisp numbers for each of the neutrosophic values by applying the deneutrosophication process. (Eq.3.2)

Step 7. According to the AHP calculations, write comparison matrices for alternatives for the criteria.

Step 8. Obtain neutrosophic weight vectors for alternatives by repeating the previous steps according to the criteria. Repeat the same process for obtaining the priority weights of the alternatives.

Step 9. Apply the deneutrosophication formula in Eq. (3.2) in order to obtain the crisp weights of alternatives.

Step 10. For testing the order of the alternatives that is given in step 9, evaluate the Euclidean - Tangent combine similarity measures for different values of lambda (namely $\lambda = 0.2, \lambda = 0.3$ and $\lambda = 0.6$) of alternatives and the ideal solution.

5. Empirical study using I- Valued Neutrosophic with AHP in airline transportation industry

Following the 10 steps given in the section above, the mentioned technique is given step by step.

In the first step of the research, the I-valued scale was determined using Table 1.
In the second step, a literature study was conducted first and the factors of airline service quality that may be associated with the pandemic were researched in order to determine the necessary alternatives and criteria. Afterwards, these identified factors of service quality were brought up for discussion by conducting a focus group study. The passengers who prefer the airline at least once a year before the pandemic broke out are included in the focus group study on a voluntary basis. Half of the passengers participating in the study were selected from among those who usually choose the airplane travel for leisure trip and the remaining half for business trip. The purpose of the focus group was explained to the participants before the study began. The study was maintained until the group participants reached a consensus with regard to attributes in the accompaniment of a specialist in focus group and also a moderator working in service marketing issues. 10 people, 6 of them are women and 4 of them are men, were included in the Focus group. Focus group participants are between 35 and 60 years old.

The attributes identified by focus group were subjected to a classification assessing by four experts and afterwards, each class of attributes was named as a dimension. Two of the experts are designated as airline directors. One of the directors were elected as woman and one as a man with ages in the interval from 40 to 60. Each manager have over 17 years of experience in this industry of the related areas. The other two people are public health professionals who work on the pandemic. The moderator is the moderator managing the passenger focus group. The dimensions of service quality that meet the most important concerns and needs of the pandemic for passengers were stated as social distance (SC), hygiene (H) and corona pandemy awereness and concern (CAC) as a result of this study. The experts have pointed out that the attributes of service quality arising from the concerns and needs of passengers regarding the pandemic may change for the pre-flight phases consisting of activities such as check-in, passenger boarding, lounge facilities, direction; in flight phases with factors such as veseating, lavatories, catering, entertainment, the cabin crews attitudes and post flight phases that are basically shaped by the passenger movement in due course of the these assessments. The selection of alternatives was completed and alternatives were determined as pre flight, in flight and post flight based upon these assesstments.

In the third stage of the research, The survey was constructed by the researchers. The whole airline service process was visualised as follows: pre-flight, in flight, and post-flight phases. The participants were asked to assess the significance of social distance, hygiene and corona pandemy awereness and concern attributes in accordance with three pre-flight, in-flight and post-flight alternatives. The sample of current passengers consisted of 402 passengers, taking

into account a 95% confidence level and a 5% error margin (DeVaus, [14]). Of the passengers, 48% were aged between 21 and 30, 49% were male, and 53% had an undergraduate degree. IVN scale used in this part of the study is shown in Table 1.

Table 2. Pairwise comparison matrix for criteria

	SC	H	CAC
SC	¡[0.5,0.5], [0.5,0.5],[0.5,0.5]¿	¡[0.2,0.3],[0.15,0.25],[0.7,0.8]¿	¡[0.0, 0.1],[0.1,0.0],[0.95,1.0]¿
H	¡[0.7,0.8],[0.15,0.25],[0.2,0.3]¿	¡[0.5,0.5],[0.5,0.5],[0.5,0.5]¿	¡[0.3,0.4], [0.25,0.35],[0.6,0.7]¿
CAC	¡[0.95,1.0],[0.1,0.0],[0.0,0.1]¿	¡[0.6,0.7],[0.25,0.35],[0.3,0.4]¿	¡[0.5 , 0.5],[0.5,0.5],[0.5,0.5]¿

In the fourth step, the sum of the columns of the pairwise comparison matrix is computed by Eq.3.3 and the normalized values are obtained (Table 3-Table 4).

Table 3. The column sums of the pairwise comparison matrix

	SC						H						CAC					
	TI	Tu	II	Iu	FI	Fu	TI	Tu	II	Iu	FI	Fu	Tl	Tu	Il	Iu	Fl	Fu
SC	0,50	0,50	0,50	0,50	0,50	0,50	0,20	0,30	0,15	0,25	0,70	0.80	0,00	0,10	0,10	0,00	0.95	1.00
H	0,70	0,80	0,15	0,25	0,20	0,30	0,5	0,5	0,5	0,5	0,5	0.5	0,30	0.40	0,25	0.35	0.60	0.70
CAC	0,95	1.00	0,1	0,00	0,00	0,10	0,6	0.7	0.25	0.35	0.3	0.4	0.5	0,5	0,5	0,5	0.5	0.5
SUM	2.15	2.3	0.75	0.75	0.7	0.9	1.3	1.5	0,9	1.1	1.5	1.7	0.80	1.00	0,85	0,85	2.05	2.20

Table 4. The normalized values of the pairwise comparison matrix

	TI	Tu	II	Iu	FI	Fu	TI	Tu	II	Uu	FI	Fu	TI	Tu	II	Uu	FI	Fu
SC	0,217	0,217	0,667	0,667	0,556	0,556	0,133	0,2	0,136	0,227	0,412	0,471	0	0,1	0,118	0	0,432	0,455
H	0,304	0,348	0,2	0,333	0,222	0,333	0,333	0,333	0,455	0,455	0,294	0,294	0,3	0,4	0,294	0,412	0,273	0,318
CAC	0,413	0,435	0,133	0	0	0,111	0,4	0,467	0,227	0,318	0,176	0,235	0,5	0,5	0,588	0,588	0,227	0,227

In the fifth step, the weights in the rows are evaluated by using Eq.3 (Table 5). In the

Table 5. The weights of criteria

	Tl	Tu	Il	Iu	Fl	Fu
SC	0,117	0,172	0,307	0,298	0,466	0.494
H	0,313	0,360	0,316	0,400	0,263	0.315
CAC	0,438	0,467	0,316	0,302	0,135	0.191

sixth step, the corresponding crisp numbers for each of the neutrosophic values are evaluate by applying the deneutrosophication process given in Eq.3.2 (Table 6). It was found that the most important dimension for the passengers among three identified criteria was the social

Table 6. Criteria deneutrosophication and ranking

Criteria	Results
SC	0,329
H	0,466
CAC	0,548

distance dimension, the second significant criterion was hygiene, and the third was the corona pandemy awereness and concern criterion in this step.

In the seventh step, according to the AHP calculations,comparison matrices for alternatives according to the criteria are writen in Table 7. Afterwards, its pairwise comparison matrix was formed on the basis of the Interval-valued neutrosophic evaluation scale of alternatives depending upon the criteria in line with AHP calculations, and presented in Table 7.

Table 7. Pairwise comparison matrices for alternatives with respect to the criteria.

	SC						H						CAC					
	TI	Tu	II	Iu	FI	Fu	TI	Tu	II	Iu	FI	Fu	Tl	Tu	Il	Iu	Fl	Fu
Pre Flight	0,357	0,313	0,455	0,385	0,357	0,313	0,235	0,286	0,20	0,263	0,359	0.372	0,314	0,333	0,316	0,348	0,333	0,36
In Flight	0,25	0,281	0,273	0,308	0,393	0,406	0,588	0,476	0,667	0,526	0,256	0.233	0,40	0.41	0,158	0.217	0.19	0.24
Post Flight	0,393	0,406	0,273	0,308	0,25	0,281	0,176	0.238	0.133	0.211	0.385	0.395	0.286	0,256	0,526	0,435	0.476	0.4

In the Eight step, the previous items according to criterions are repeated and calculated weights vectors. Then the same items are repeated (Table 8). Table 8 gives the weights of Alternatives.

Table 8. The Weights of Alternatives

	Tl	Tu	Il	Iu	Fl	Fu
Pre Flight	0,302	0,311	0,323	0,332	0,350	0,348
In Flight	0,413	0,389	0,366	0,350	0,280	0,293
Post Flight	0,285	0,300	0,311	0,318	0,370	0,359

At this step, the formula in Eq. (1) is applied for obtaining the crisp weights as in Table 9. According to this order, in flight, pre flight and post flight were listed (Table 9).

Table 9. Alternative deneutrosophication and ranking

	Results
Pre Flight	0,434
In Flight	0,492
Post Flight	0,423

At the last step, for testing the order of the alternatives that is given in Table 9, the Euclidean-Tangent combine similarity measures for different values of lambda (namely $\lambda = 0.2, \lambda = 0.3$ and $\lambda = 0.6$) of alternatives and the ideal solution are evaluated (Table 10, Table 11 and Table 12). Similarity tests were performed and compared with an ideal solution in order to test the alternative ranking shown in Table 9. These results are presented in Table 10, Table 11 and Table 12. The reason for presenting as three separate tables is that the Lambda values in the similarity test are shown to be different, although there is no change in the ranking.

Table 10. Euclidean - Tangent Combine Similarity ($\lambda = 0,2$)

Similarity between	SC	H	CAC	Overall
Pre Flight & In Flight	0,948	0,868	0,935	0,917
In Flight & Post Flight	0,945	0,825	0,890	0,887
Pre Flight & Post Flight	0,948	0,974	0,944	0,955
Pre Flight & IDEAL	0,752	0,755	0,760	0,756
In Flight & IDEAL	0,745	0,762	0,813	0,773
Post Flight & IDEAL	0,793	0,744	0,715	0,751

Table 11. Euclidean - Tangent Combine Similarity ($\lambda = 0,3$)

Similarity between	SC	H	CAC	Overall
Pre Flight & In Flight	0,947	0,869	0,935	0,917
In Flight & Post Flight	0,945	0,823	0,890	0,886
Pre Flight & Post Flight	0,947	0,974	0,945	0,955
Pre Flight & IDEAL	0,752	0,755	0,760	0,756
In Flight & IDEAL	0,745	0,761	0,813	0,773
Post Flight & IDEAL	0,793	0,744	0,714	0,751

Table 12. Euclidean - Tangent Combine Similarity ($\lambda = 0,6$)

Similarity between	SC	H	SAC	Overall
Pre Flight & In Flight	0,935	0,871	0,934	0,913
In Flight & Post Flight	0,945	0,821	0,892	0,886
Pre Flight & Post Flight	0,935	0,974	0,947	0,952
Pre Flight & IDEAL	0,740	0,756	0,761	0,752
In Flight & IDEAL	0,746	0,760	0,814	0,773
Post Flight & IDEAL	0,794	0,745	0,713	0,751

6. **Discussion and Conclusion**

Two of the three criteria specified as the criteria of service quality with regard to the established pandemic appeared as the two most highlighted measures concerning the pandemic rather than the sectoral basis in the study. The third criterion can be evaluated in a more sectoral basis. The criteria of service quality identified in consequence of the study correspond to the study results of Chou and Lu ([11]). Hygiene and social distance are determined as the elements on which the passengers focus most in different studies in a similar way. Similarly, tangible cues referred to as "airline tangibles" by Ekiz et al. ([15]) emphasizes similar necessities.

Farooq ([16]) and Gudmundsson ([19]) wasrecognize with quality of interior and exterior equipments, catering service, comfortable seats and cleanliness (Ali et al., [2]). Seat space and Legroom and seat comfort attributes have been introduced in the studies of Chen and Chang ([9]), Nejati et al. ([28]), Chang and Yeh ([8]), Liou and Tzeng ([26]), Gupta ([20]) have been previously emphasized among airline service quality issues in relation to social distance. The emphasis on hygiene and cleanliness has been demonstrated in several studies except from pandemic context. (Chen and Chang, [9]; Chang and Yeh, [8]; Liou and Tzeng, [26]; Gilbert and Wong, [17]; Nejati et al., [28]; Chen and Chang, [9]; Jiang and Zhang, [22]; Gupta, [20]). In particular, it is often mentioned as cleanliness of seats. Baker et al. ([4]) and Wu et al. ([36]) also drew attention to the corona pandemy awereness and concerns in their studies. Babbar and Koufteros [3] attracted attention to the significance of level of concern in the context of service of airline quality. The ranking of significance of these criteria as in-flight, pre-flight and post-flight (De Neufville, [13]; Camilleri, [6]) does not match up with the results of the study of Namukasa [38]. It has been found out that the service quality in the pre - flight, in - flight and post - flight phases has equally importance. This non-overlapping situation is considered to arise from the concentrate on the three elements in the context of the pandemic.

Intense requests for cancelation and various government measures owing to COVID-19 pandemic, which the aviation industry has never seen before, have forced many airline companies to call billions of dollars in emergency assistance whilst others have directed their crew to take voluntary leave in order not to dismiss their crew. It is considered that the recovery of the sector is possible only with medium and long term planning, by constantly following the effects of the pandemic and by fulfilling all the undertakings of governments and financial institutions. Above all, the passengers must be persuaded to use the airline again. The service quality is regarded as a competitive marketing strategy, particularly in the airline industry as Andotra et al. [3] stated. It has significance that the airline companies spend less time, effort and charges on the relatively less important elements, by focusing on service quality elements which are most important to their customers . The presence of a substantive relationship

between service quality and customer satisfaction is frequently emphasized in the related literature (Ali et al., [2]). In this sense, the results of this study consist of several significant assessments for the airline companies in order to regain and convince their passengers. The ranking of alternatives in all of the similarity tests conducted in order to test the reliability of Interval Neutrosophic AHP at the same time is completely compatible with the ranking made with Interval Neutrosophic AHP (Table 10-11-12). The post Flight status is always closer to the ideal when the similarity test is analyzed on the basis of criteria, in terms of Social distance criterion. The general ranking is not disrupted in the ranking of the Hygiene and Corona Pandemic Awareness and Concern Criteria.

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