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RANKING THE LIBYAN AIRLINES BY USING FULL CONSISTENCY METHOD (FUCOM) AND ANALYTICAL HIERARCHY PROCESS (AHP)

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Abstract. *Performance measurement and evaluation of the airlines are a key point for improving their performance. This evaluation can help achieving the airline targets. The aim of this paper is to evaluate and compare the performance of four Libyan airlines by considering five main areas of performance; the airline reliability, employees, management, customer's satisfaction and tangibles. In this work, a hybrid method which combined the Full Consistency Method (FUCOM) and Analytical Hierarchy Process (AHP) in one system has been used to assess the four Libyan airlines. In the AHP method, the number of the required pairwise comparisons are increases dramatically with the number of the elements to be compared. The more the comparisons are the higher is the likelihood that the decision maker will introduce erroneous data. In this regard, the problem has been solved by means of using integer, decimal values from the predefined scale for the pairwise comparison of the criteria. The results show that the reliability is the most important performance area followed by satisfaction. Among the four investigated airlines, Libyan Wings were ranked first with a total 0.392 score.*

Key words: *Libyan airlines, AHP, FUCOM, MCDM.*

1. Introduction

In today's competitive market within the airline industry, delivering high-quality service has become a global marketing need. One of the key elements for airline modern industry is the evaluation of performance and effectiveness. This can support achieving the company objectives, and compare their performance with the similar best practices' businesses. In order to achieve these higher-quality levels,

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airlines need to develop a methodology to make this measurement in a profitable manner.

The air transport industry plays an important role in Africa, while it provides the essential links for the economic and physical integration in the continent. The network of the other transportation service could be inadequate. Despite the great potential and the rapid growth of air transport, Africa's share in the global air transport industry stills insignificant. The state of air transport industry in Africa is about 2.85% and 2% of global revenue passenger kilometer and global airport income respectively, and about 1% of global airlines' cargo (Njoya, 2016). Furthermore, only around 20% of intercontinental traffic between Africa and the rest of the world is controlled by African airlines. (Amankwah-Amoah, 2018).

There are many internal and external elements that lead to the limited competitiveness of the African airlines. Some of these external factors are slow implementation of the YD and protection of state-owned airlines, which have leads to the unfair competition. Furthermore, the internal factors such as limited economies of scale and quality of service have affected the ability of competition of some airlines (Amankwah-Amoah, 2018).

None of the above-mentioned studies have considered Libyan airlines in their investigation. This study responds to this need by using a list of Key Performance Indicators to assess a number of aspects of airline's performance. The aim of this work is to use a set of key performance indicators to measures and evaluate the performance of Libyan airlines. A questionnaire survey was used to gather expertise opinions across Libya. The responses to the questionnaire were then analyzed and studied with a new method which companies the Analytic Hierarchy Process (AHP) methodology and Full Consistency Method (FUCOM) in one system. The FUCOM technique was used to determine the relative weight of the KPIs and then ranked the Libyan airlines using AHP according to their KPIs.

The paper is organized as follows. Section 2 presents a literature review on MCDM Methods. Section 3 presents the Full Consistency Method FUCOM. In section 4, the case study is presented and discussed, where sixteen indicators were used to determine the performance of the airlines. Section 5 presented the determination of the weights using FUCOM method and compares it to results obtained by the AHP method, and ranks the Libyan airlines using AHP method. Finally, Section 6 presents the conclusion remarks that emerged from the analysis of the case study.

2. Literature review

Multi Criteria Decision Making MCDM methods are gaining more popularity in many fields such as logistics, supply chain management, energy, urban development, waste management, and passenger satisfaction measurement (Pamučar and Ćirović, 2015); (Tsafarakis et al., 2018, Milosavljević et al., 2018); (Petrović and Kankaraš, 2018); (Liu et al., 2018); (Vesković et al., 2018); (Pamučar et al., 2018a). MCDM methods generally work as a decision support tool to the problems containing multiple and conflicting objectives.

One of the most popular methods in MCDM techniques is Analytic Hierarchy Process (AHP) (Zietsman and Vanderschuren, 2014), which introduced by Thomas L. Saaty in 1977 (Saaty, 1980). According to (Mardani et al., 2016), AHP and its modified forms are the most commonly used methods for evaluating of transportation systems. AHP is based on the following four main components:

- Define the problem and determine the type of information required
- Structure the problem as a hierarchy
- Conduct pairwise comparisons among all criteria at every level within the hierarchy
- Compute the relative weights of the criteria

Barros and Wanke (Barros and Wanke, 2015) used two-stage TOPSIS method and neural networks to analyses the African airlines efficiency. Because of its location, Libya has a good opportunity to be a strategic air transport hub. Maertenz et al (Maertens et al., 2014) focused on the traffic between Africa and Europe and evaluates the prospects of an air transport operation in Libya. They developed a weighted average distance penalty (WADP) indicator and applied it to Tripoli airport as a potential hub location. Recently, Eshtaiwi et al. (Eshtaiwi et al., 2018) developed a set of KPI’s to evaluate the performance of the Libyan airports. The grey theory model has been used to evaluate the Libyan airports (Eshtaiwi et al., 2017). Mahtani and Garg (Mahtani and Garg, 2018) adopts a multi-criteria decision making (MCDM) approach based on the technique of fuzzy Analytical Hierarchy Processing (AHP). The results indicate that that financial factors are the most critical and categorized as a major influence on the commercial stability of the airlines. Results also show that annual inflation and GDP growth rate in the country has a major influence on the sustainability of the airlines in India. Karman and Akman (Karaman and Akman, 2018) used the Analytical Hierarchical Process (AHP) to Turkish airline industry to assess and weigh the CSR program criteria among multiple alternatives. Questionnaires based on the pairwise comparison, answered by a number of experts working in different major airline companies, are used to assess the relative importance of related factors. Then, fuzzy linguistic variables are adopted to rank the selected CSR programs of airliner companies. The results indicate that CSR paradigm in the airline industry is envisaged within a restricted economic realm besieging social and environmental dimensions, rather than within the totality of systemic efforts towards multi-faceted issues.

High-quality service has become a requirement in the market among air carriers, and helps companies to gain and maintain customer loyalty. It also leads to creating competitive pressure among air carriers (Chen et al., 2011). Tsafarakis et al. (Tsafarakis et al., 2018) suggested a model for airline passenger satisfaction measurement and service quality improvement. In this context, no research has been done regarding the airline’s performance measurements in Libya.

3. The Full Consistency Method FUCOM

FUCOM (Pamučar et al., 2018b) is a new MCDM method for determination criteria weights. The problems of multi-criteria decision-making are characterized by the choice of the most acceptable alternative out of a set of the alternatives presented on the basis of the defined criteria. A model of multi-criteria decision-making can be presented by a mathematical equation

$\max\left[f_1(x), f_2(x), \ldots, f_n(x)\right],\ n \geq 2$, with the condition that $x \in A = \left[a_1, a_2, \ldots, a_m\right]$; where *n* represents the number of the criteria, *m* is the number of the alternatives, *fj* represents the criteria ($j = 1, 2, \ldots, n$) and *A* represents the set of the alternatives a_i ($i = 1, 2, \ldots, m$). The values f_{ij} of each considered criterion f_j for each considered alternative a_i are known, namely $f_{ij} = f_j(a_i),\quad \forall(i, j);\ i = 1, 2, \ldots, m;\ j = 1, 2, \ldots, n$. The relation shows that each value of the attribute depends on the j^{th} criterion and the i^{th} alternative.

Real problems do not usually have the criteria of the same degree of significance. It is therefore, necessary that the significance factors of particular criterion should be defined by using appropriate weight coefficients for the criteria, so that their sum is one. Determining the relative weights of criteria in multi-criteria decision-making model is always a specific problem inevitably accompanied by subjectivity. This process is very important and has a significant impact on the final decision-making result, since weight coefficients in some methods crucially influence the solution. Therefore, particular attention in this paper is paid to the problem of determining the weights of criteria, and the new FUCOM model for determining the weight coefficient of criteria is proposed. This method enables the precise determination of the values of the weight coefficients of all the elements mutually compared at a certain level within the hierarchy, simultaneously satisfying the conditions of the comparison consistency.

In real life, pairwise comparison values $a_{ij} = w_i / w_j$ (where a_{ij} shows the relative preference of criterion *i* to criterion *j*) are not based on accurate measurements, but rather on subjective estimates. There is also a deviation of the values a_{ij} from the ideal ratios w_i / w_j (where w_i and w_j represents criteria weights of criterion *i* and criterion *j*). If, for example, it is determined that A is of much greater significance than B, B of greater importance than C, and C of greater importance than A, there is inconsistency in problem solving and the reliability of the results decreases. This is especially true when there are a large number of the pairwise comparisons of criteria. FUCOM reduces the possibility of errors in a comparison to the least possible extent due to: (1) a small number of comparisons (*n-1*) and (2) the constraints defined when calculating the optimal values of criteria. FUCOM provides the ability to validate the model by calculating the error value for the obtained weight vectors by determining DFC. On the other hand, in the other models for determining the weights of criteria (the BWM, the AHP models), the redundancy of the pairwise comparison appears, which makes them less vulnerable to errors in judgment, while the FUCOM methodological procedure eliminates this problem.

In the following section, the procedure for obtaining the weight coefficients of criteria by using FUCOM is presented.

Step 1. In the first step, the criteria from the predefined set of the evaluation criteria $C = \{C_1, C_2, \ldots, C_n\}$ are ranked. The ranking is performed according to the significance of the criteria, i.e. starting from the criterion which is expected to have the highest weight coefficient to the criterion of the least significance. Thus, the criteria ranked according to the expected values of the weight coefficients are obtained:

$$C_{j(1)} > C_{j(2)} > \ldots > C_{j(k)} \tag{1}$$

where *k* represents the rank of the observed criterion. If there is a judgment of the existence of two or more criteria with the same significance, the sign of equality is placed instead of “>” between these criteria in the expression (1)

Step 2. In the second step, a comparison of the ranked criteria is carried out and the *comparative priority* ($\varphi_{k/(k+1)}$, $k = 1, 2, \ldots, n$, where *k* represents the rank of the criteria) of the evaluation criteria is determined. The comparative priority of the evaluation criteria ($\varphi_{k/(k+1)}$) is an advantage of the criterion of the $C_{j(k)}$ rank compared to the criterion of the $C_{j(k+1)}$ rank. Thus, the vectors of the comparative priorities of the evaluation criteria are obtained, as in the expression: (2)

$$\Phi = \left(\varphi_{1/2}, \varphi_{2/3}, \ldots, \varphi_{k/(k+1)}\right) \tag{2}$$

where $\varphi_{k/(k+1)}$ represents the significance (priority) that the criterion of the $C_{j(k)}$ rank has compared to the criterion of the $C_{j(k)}$ rank.

The comparative priority of the criteria is defined in one of the two ways defined in the following part:

a) Pursuant to their preferences, decision-makers define the comparative priority $\varphi_{k/(k+1)}$ among the observed criteria. Thus, for example, if two stones A and B, which, respectively, have the weights of $w_A = 300$ grams and $w_B = 255$ grams are observed, the comparative priority ($\varphi_{A/B}$) of Stone A in relation to Stone B is $\varphi_{A/B} = 300/255 = 1.18$. Also, if the weights A and B cannot be determined precisely, but a predefined scale is used, e.g. from 1 to 9, then it can be said that stones A and B have weights $w_A = 8$ and $w_B = 7$. respectively. Then the comparative priority ($\varphi_{A/B}$) of Stone A in relation to Stone B can be determined as $\varphi_{A/B} = 8/7 = 1.14$. This means that stone A in relation to stone B has a greater priority (weight) by 1.18 (in the case of precise measurements), i.e. by 1.14 (in the case of application of measuring scale). In the same manner, decision-makers define the comparative priority among the observed criteria $\varphi_{k/(k+1)}$. When solving real problems, decision-makers compare the ranked criteria based on internal knowledge, so they determine the comparative priority $\varphi_{k/(k+1)}$ based on subjective preferences. If the decision-maker thinks that the criterion of the $C_{j(k)}$ rank has the same significance as the criterion of the $C_{j(k+1)}$ rank, then the comparative priority is $\varphi_{k/(k+1)} = 1$.

b) Based on a predefined scale for the comparison of criteria, decision-makers compare the criteria and thus determine the significance of each individual criterion in the expression (1). The comparison is made with respect to the first-ranked (the most significant) criterion. Thus, the significance of the criteria ($\varpi_{C_{j(k)}}$) for all of the criteria ranked in Step 1 is obtained. Since the first-ranked criterion is compared with itself (its significance is $\varpi_{C_{j(1)}}=1$), a conclusion can be drawn that the *n-1* comparison of the criteria should be performed.

For example: a problem with three criteria ranked as C2>C1>C3 is being subjected to consideration. Suppose that the scale $\varpi_{C_{j(k)}} \in [1,9]$ is used to determine the priorities of the criteria and that, based on the decision-maker's preferences, the following priorities of the criteria $\varpi_{C_2}=1$, $\varpi_{C_1}=3.5$ and $\varpi_{C_3}=6$ are obtained. On the basis of the obtained priorities of the criteria and condition $\frac{w_k}{w_{k+1}}=\varphi_{k/(k+1)}$ we obtain following calculations $\frac{w_2}{w_1}=\frac{3.5}{1}$ i.e. $w_2=3.5\cdot w_1$, $\frac{w_1}{w_3}=\frac{6}{3.5}$ i.e. $w_1=1.714\cdot w_3$. In that way, the following comparative priorities are calculated: $\varphi_{C_2/C_1}=3.5/1=3.5$ and $\varphi_{C_1/C_3}=6/3.5=1.714$ (expression (2)).

As we can see from the example shown in Step 2b, the FUCOM model allows the pairwise comparison of the criteria by means of using integer, decimal values or the values from the predefined scale for the pairwise comparison of the criteria.

Step 3. In the third step, the final values of the weight coefficients of the evaluation criteria $(w_1, w_2, ..., w_n)^T$ are calculated. The final values of the weight coefficients should satisfy the two conditions:
(1) that the ratio of the weight coefficients is equal to the comparative priority among the observed criteria ($\varphi_{k/(k+1)}$) defined in *Step 2*, i.e. that the following condition is met:

$$\frac{w_k}{w_{k+1}}=\varphi_{k/(k+1)} \tag{3}$$

(2) In addition to the condition (3), the final values of the weight coefficients should satisfy the condition of mathematical transitivity, i.e. that $\varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)}=\varphi_{k/(k+2)}$. Since $\varphi_{k/(k+1)}=\frac{w_k}{w_{k+1}}$ and $\varphi_{(k+1)/(k+2)}=\frac{w_{k+1}}{w_{k+2}}$, that $\frac{w_k}{w_{k+1}} \otimes \frac{w_{k+1}}{w_{k+2}}=\frac{w_k}{w_{k+2}}$ is obtained. Thus, yet another condition that the final values of the weight coefficients of the evaluation criteria need to meet is obtained, namely:

$$\frac{w_k}{w_{k+2}} = \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)} \tag{4}$$

Full consistency i.e. minimum DFC (χ) is satisfied only if transitivity is fully respected, i.e. when the conditions of $\frac{w_k}{w_{k+1}} = \varphi_{k/(k+1)}$ and $\frac{w_k}{w_{k+2}} = \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)}$ are met. In that way, the requirement for maximum consistency is fulfilled, i.e. DFC is $\chi = 0$ for the obtained values of the weight coefficients. In order for the conditions to be met, it is necessary that the values of the weight coefficients $(w_1, w_2, ..., w_n)^T$ meet the condition of $\left|\frac{w_k}{w_{k+1}} - \varphi_{k/(k+1)}\right| \le \chi$ and $\left|\frac{w_k}{w_{k+2}} - \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)}\right| \le \chi$, with the minimization of the value χ. In that manner the requirement for maximum consistency is satisfied.

Based on the defined settings, the final model for determining the final values of the weight coefficients of the evaluation criteria can be defined.

$$\begin{aligned}
&\min \chi \\
&s.t. \\
&\left|\frac{w_{j(k)}}{w_{j(k+1)}} - \varphi_{k/(k+1)}\right| \le \chi,\ \forall j \\
&\left|\frac{w_{j(k)}}{w_{j(k+2)}} - \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)}\right| \le \chi,\ \forall j \\
&\sum_{j=1}^{n} w_j = 1,\ \forall j \\
&w_j \ge 0,\ \forall j
\end{aligned} \tag{5}$$

By solving the model (5), the final values of the evaluation criteria $(w_1, w_2, ..., w_n)^T$ and the degree of DFC (χ) are generated.

4. The case study

Expectations and actual services delivered to the customer could be used as a definition for service quality. Many activities can be used as a measure for service quality functions performed by the airlines such as ticket reservation, purchasing, check-in, comfortable and safe travelling and value-added services, such as on-board services, seat comfort, and cleanliness, luggage transportation, promotional incentives, including frequent membership programs and miles rewards, lost baggage handling and services for delayed passengers. Thus, service quality categories can be seen as a combination of various subjective and objective factors, which are difficult to evaluate appropriately.

For the purpose of assessing the Libyan airlines, sixteen indicators were used, as shown in Fig. 1. In this paper we follow the indicators suggested by (Perçin, 2018), which categorized the indicators into five groups as follows:

- Reliability: This category typically includes flight schedule and frequency, on-time performance and flight safety and security.
- Employees: The attitude among the employees towards the customers affects customers' expectations of airline service quality. Therefore, employee courtesy, responsiveness and neat appearance will probably positively influence passengers' perceptions of the airline.
- Management: A good management system is necessary for providing high-quality services to the customers. Therefore, service efficiency, service diversification and flight crew competence help airlines to satisfy customer needs.
- Satisfaction: This category includes the ability of the employees for handling customer complaints and solving problems regarding reservations, check-in, ticketing, baggage, flight delays, cancellations, and boarding situations. Nevertheless, the airline's competitive strengths can affect by the employee inability or unwillingness to handle customer complaints.
- Tangibles: Some other indicators like in-flight services such as airplane comfort and cleanliness, on-board entertainment (movies, magazines, etc.) and on-board services (meals and drinks) are of an important role on passenger satisfaction and perception of an airline's service quality.

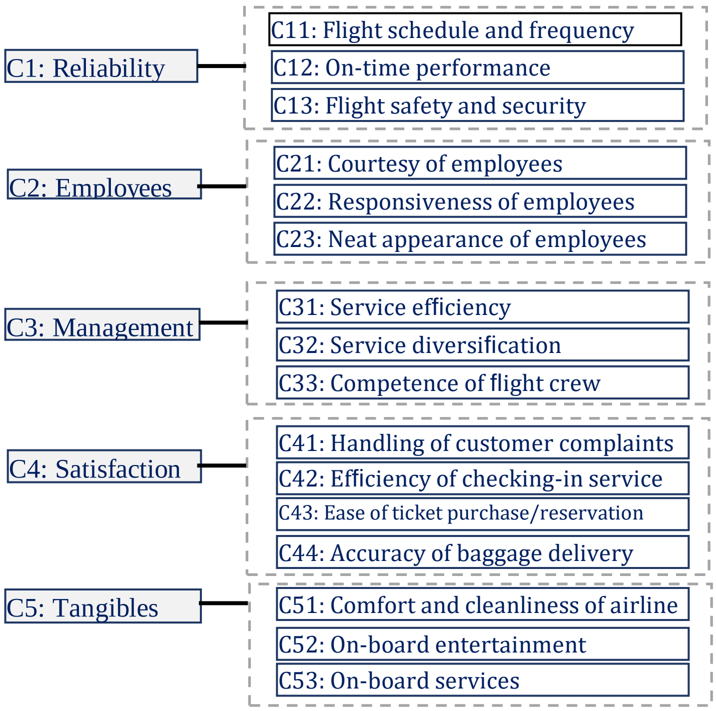

Figure 1. Performance indicators for airlines service quality measurement

There are 13 airlines operates in Libya. The four major airlines are:

Libyan airlines: It operates scheduled passenger and cargo services within Libya and to Europe, Middle east and North Africa. It founded on 1964. The company is100% owned by the government.

Afriqyiah Airways: It is a state-owned airline. It founded on 2001. It is operated domestically and to Europe, Africa, Asia, and middle east.

Libyan wings: It started operations in 2015. It is operated domestically and to two destinations (Turkey and Tunisia).

Buraq air: Founded in 2001. It operates scheduled domestic and international services to Europe, North Africa, and the Middle East.

5. Results and analysis

5.1. Results by AHP method

Table 1 shows the pairwise comparison of the main indicators, with consistency ratio (CR) equal to 10% (Saaty, 1990).

Table 1: Pairwise comparison of the main categories

	C1	C2	C3	C4	C5	ωj
C1	1	5	4	3	7	0.503
C2	1/5	1	½	1/3	1	0.077
C3	1/4	2	1	1/2	2	0.132
C4	1/3	3	2	1	3	0.216
C5	1/7	1	½	1/3	1	0.071
			CR=0.010			

5. 2. Determining the weight of the main criteria using the FUCOM method

Step 1. In the first step, the decision-makers performed the ranking of the criteria: C1> C4> C3> C2 >C5.

Step 2. In the second step (Step 2b), the decision-maker performed the pairwise comparison of the ranked criteria from Step 1. The comparison was made with respect to the first-ranked C2 criterion. The comparison was based on the scale $[1,9]$. Thus, the priorities of the criteria ($\varpi_{C_{j(k)}}$) for all of the criteria ranked in Step 1 were obtained (Table 2).

Table 2. Priorities of criteria

Criteria	C_1	C_4	C_3	C_2	C_5
$\varpi_{C_{j(k)}}$	1	2.7	5	5.5	5.8

Based on the obtained priorities of the criteria, the comparative priorities of the criteria are calculated: $\varphi_{C_1/C_4} = 2.7/1 = 2.7$, $\varphi_{C_4/C_3} = 5/2.7 = 1.852$, $\varphi_{C_3/C_2} = 5.5/5 = 1.1$, $\varphi_{C_2/C_5} = 5.8/5.5 = 1.055$.

Step 3. The final values of weight coefficients should meet the following two conditions:

a) The final values of the weight coefficients should meet the condition (3), i.e. that $\frac{w_1}{w_4} = 2.7$, $\frac{w_4}{w_3} = 1.852$, $\frac{w_3}{w_2} = 1.1$, $\frac{w_2}{w_5} = 1.055$.

b) In addition to the condition (3), the final values of the weight coefficients should meet the condition of mathematical transitivity, i.e. that $\frac{w_1}{w_3} = 2.7 \times 1.852 = 5$, $\frac{w_4}{w_2} = 1.852 \times 1.1 = 2.037$, $\frac{w_3}{w_5} = 1.1 \times 1.055 = 1.16$. By applying the expression (5), the final model for determining the weight coefficients can be defined as:

$$\min \chi$$

$$s.t.\begin{cases} \left|\frac{w_1}{w_4} - 2.70\right| \le \chi,\ \left|\frac{w_4}{w_3} - 1.852\right| \le \chi,\ \left|\frac{w_3}{w_2} - 1.1\right| \le \chi,\ \left|\frac{w_2}{w_5} - 1.055\right| \le \chi, \\ \left|\frac{w_1}{w_3} - 5.00\right| \le \chi,\ \left|\frac{w_4}{w_2} - 2.037\right| \le \chi,\ \left|\frac{w_3}{w_5} - 1.16\right| \le \chi, \\ \sum_{j=1}^{5} w_j = 1,\ w_j \ge 0, \forall j \end{cases}$$

By solving this model, the final values of the weight coefficients $(0.520, 0.094, 0.104, 0.192, 0.090)^T$ and DFC of the results $\chi = 0.00016$ are obtained. The value of the criteria according to the marks given at the beginning is shown in Table 4. The model is solved using the Lingo17 software. From obtained results it can be concluded that the most important criterion is C1, followed by the criterion C4.

Table 3 presents the weight of the KPAs and KPIs. In terms of key performance areas, reliability have got the most important weight with a value of 0.506. The satisfaction ranked next with a value of 0.216, followed by the management with value of 0.0.131. Employees perspective (0.091) is ranked the fourth most important area, while the tangibles (0.059) is the least important performance area. In KPIs terms, on-time performance (0.289) is regarded as the most important indicator. Flight safety and security is the second most important key performance indicator with a value of 0.115.

Table 3: Criteria weights

Crieria	Sub-criteria	Weights (AHP)	Weights (FUCOM)
C1: Reliability		0.506	0.520
	C11: Flight schedule and frequency	0.072	0.068
	C12: On-time performance	0.289	0.306
	C13: Flight safety and security	0.145	0.146
C2: Employees		0.076	0.094
	C21: Courtesy of employees	0.016	0.021
	C22: Responsiveness of employees	0.042	0.050
	C23: Neat appearance of employees	0.018	0.023
C3: Management		0.131	0.104
	C31: Service efficiency	0.082	0.063
	C32: Service diversification	0.018	0.016
	C33: Competence of flight crew	0.031	0.025
C4: Satisfaction		0.216	0.192
	C41: Handling of customer complaints	0.053	0.039
	C42: Efficiency of checking-in service	0.047	0.033
	C43: Ease of ticket purchase/reservation	0.021	0.028
	C44: Accuracy of baggage delivery	0.94	0.098
C5: Tangibles		0.071	0.090
	C51: Comfort and cleanliness of airline	0.024	0.029
	C52: On-board entertainment	0.007	0.009
	C53: On-board services	0.040	0.052

The results obtained during this work can help the Libyan airlines to compare their performance against others in the future based on the values of the evaluated KPIs. Furthermore, the results can be used as a bases for the airlines to perform internal benchmarking by comparing the performance of different areas with itself during a period of time. The hybrid method which combined the FUCOM method and AHP analysis has been used to select the best practices for the Libyan airlines as follows: Libyan Wings ranked first with the highest importance weight of 0.392. Afriqiyah airlines ranked second with a value of 0.261, followed by Libyan airlines with a value of 0.202, and at last Buraq airlines with score of 0.145, respectively. These scores illustrated that Libyan Wings is the most efficient airlines in Libya according to the experts' opinions. Fig. 2 illustrates the performance of the four airlines in the five key performance areas. In this regards, Libyan Wings airline has the best performance in every area in comparison to the other airlines. On the other hand, Buraq airline has a low performance in management area. Buraq airline has the lowest individual score in three dimensions.

Pairwise comparisons judgements in the AHP (see Table 2) assume that the decision-maker can compare any two elements at the same level within the hierarchy and provide a numerical value for the ratio to their importance. However, a major disadvantage is that the number of the required comparisons increases quadratically with the number of the elements to be compared. Thus, in the proposed method, the assessment of the priorities from the pairwise comparison intervals will be formulated as integer, decimal values or the values from the predefined scale for the pairwise comparison with the criteria, in this regard the proposed method will maximize the decision-maker's satisfaction with a specific crisp priority vector.

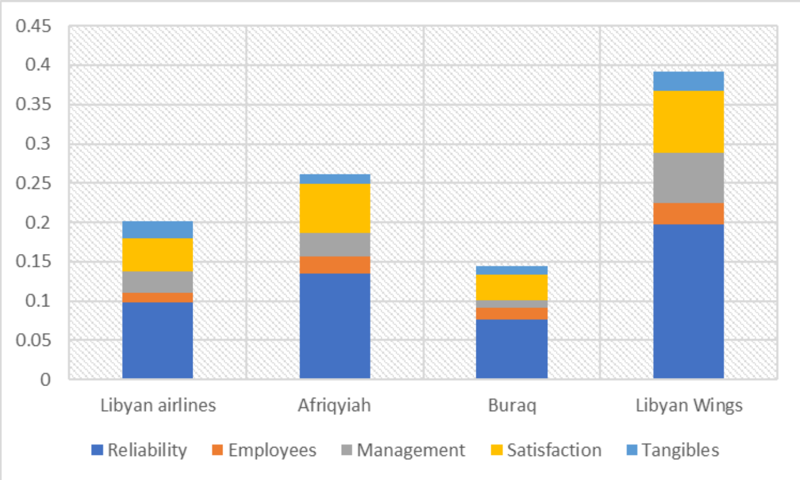

Figure 2: performance of the Libyan airlines

6. Conclusion

This paper used a set of key performance indicators to measure the performance of Libyan airlines. The value obtained in this research can be used by the Libyan airlines to benchmark their performance with other airlines which operates in similar environments. Full Consistency Method (FUCOM) and Analytical Hierarchy Process (AHP) method has been combined in one system in order rank the performance measures. The advantages of FUCOM model is that allows the pairwise comparison of the criteria by means of using integer, decimal values or the values from the predefined scale for the pairwise comparison of the criteria. The results showed that the reliability of the airline and the satisfaction areas are the most important area measures. Considering airlines ranking, Libyan Wings airline is the highest ranked airline followed by Afriqiah airline, Libyan airline, and at last Buraq airline. The model can be used as a decision support tool to improve the airlines performance. Through this paper are demonstrated advantages of FUCOM method in comparison with AHP.

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