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ONE OF THE WAYS TO IDENTIFY THE WEIGHTS OF INDICATORS OF THE FUZZY ANALYTICAL HIERARCHY PROCESS FOR DETERMINING BSC OF AN AIRLINE COMPANY

Summary. This article presents the justification for the relevance of the method for assessing the performance of an airline company. Based on a survey of foreign sources, it was proposed to use the integrated method of the analytic hierarchy process using the example of "Air Astana". The results of the method are described based on the determination of effective indicators. The conclusions are arrived at on the expediency of applying the fuzzy analytic hierarchy process (FAHP) approach for the evaluation the airline's performance. The priority (importance) and weight of all perspectives and the corresponding indicators are determined according to the proposed method. A method of assessing the probability degree of fuzzy numbers is applied to calculate the weights of the indicators (perspectives). The results of the study show that the company will be able to monitor the effectiveness of its activities using selected indicators for each perspective. The application of the instruments enhances the effectiveness of management activities of the airline and confirms the relevance of a follow-up study of the problem. This approach can be used for the management of companies in different sectors of the national economy to enhance the efficiency of management decision-making.

1. INTRODUCTION

Due to modern market conditions, it is necessary to move towards new business practices and management techniques. This calls for managers to change the principles of management to navigate the external environment and to adapt the company to customers' needs and market conditions. The financial situation of the airline industry depends largely on the choice of economic strategies for functioning in a competitive market environment and on managerial decisions taken [1]. Traditional management methods, based on simple extrapolation of experience, have been proven to be ineffective in the current context. It is important to emphasize that management decisions require not only analysis of the work performed but also a foresight of the prospects as well. Those who will be able to anticipate the market situation and organize well-established work of the company will survive and those who will not be able to adapt in good time will be pushed out of the market by successful competitors.

A modern approach to the development of a company's internal management system involves the introduction of such an innovative method as a balanced scorecard system (BSC), which enables effective management of development of a company. BSC is a tool for transforming the general vision

of the future and sophisticated strategic intents into specific objectives with quantitative attributes and for assessing the company's performance in the context of achieving these objectives [2].

We propose use of an integrated analytic hierarchy process to develop an efficient BSC airline. The international airline "Air Astana," the type of activity is regular air transportation of passengers, baggage, air cargo traffic and mail traffic on the air routes of the Republic of Kazakhstan and abroad, is the focus of this study. The airline was established in 2001, with the Government holding a 51 percent share and BAE Systems PLC holding 49 percent share [3].

2. BALANCED SCORECARD AND ITS BENEFITS

Against the background of rapidly growing competition, the world market for goods and services is expanding. Each company is challenged to improve the efficiency of its business. Addressing the challenge only through financial indicators will undoubtedly lead to collapse. A comprehensive approach is needed, a common strategy for business development and improved efficiency. Experience shows that an effective system of strategic planning and management in the company in most cases will provide the basis for improving financial performance, enhancing the quality of management decisions and adaptation to changing environments. The availability of such a system will also allow the company to gain a sustainable competitive advantage in its business segments of the market [4].

The BSC, which was first proposed by Harvard University professors Robert Kaplan and David Norton in 1990, is one of the modern approaches of strategy development and formulation [5]. Initially, the authors pursued the objective of developing a model that would assess the performance of any company. However, they created a tool not only for the development but also for the implementation of the strategy, i.e., they pointed the way: how to make sure that each member of the company with a different number of employees is aware of the goals of the company, and how to encourage personnel to achieve the proposed goals within a specified time frame.

In such a way, the concept of creating a strategic management system and evaluating its effectiveness involves the transformation of the company's strategy into a system of interrelated and balanced indicators. The business model is visualized on a strategic map, which enables managers to consider the cause-and-effect linkages in setting objectives. The BSC complex implies clear setting of objectives in the form of target values of indicators [6].

3. LITERATURE REVIEW OF THE BSC

Previous studies on the construction of BSCs based on various methods in economic sectors have been reviewed and are presented below.

The author proposes a hybrid approach [7]. The Analytical Network Process (ANP) is used to analyze dependency aspects, The Decision Making Trial and Evaluation Laboratory (DEMATEL) is used to work with interactive criteria, and the fuzzy sets theory is used for uncertainty evaluation. Four BSC and 22 criteria are evaluated for a private university of Science and Technology in Taiwan.

The importance of the BSC for improving the training of accountants at Jordanian universities was discussed [8]. Data analysis was carried out by applying multiple regression models on a sample of 134 faculty members in the accounts department and managers in Jordanian universities. The authors found a statistically significant positive relation between BSC implementation and the improvement of accounting education indicators.

The purpose of study was to develop a conceptual framework for the creation of a Green Transport (GT) BSC model from the perspective of industrial companies and the supply chain based on the appropriate multi-criteria decision-making technique [9]. The Analytical Network Process (ANP) was used as a suitable multi-criteria decision-making technique for prioritizing GTBSC measures.

The study explores the effectiveness of BSC in relation to the performance of banks in Nigeria as one of the most relevant issues in the banking sector [10]. The study was based on the factual study design and used the historical data of five selected banks covering an eleven-year period (2007-2017).

The EX POST FACTO Law (ex post facto is a law that retroactively changes the legal consequences of past amendments) was used. A quantitative estimation of a balanced scorecard based on the Crisp method and Fuzzy Multiple Attribute Decision Making Methods was used in an Indian bank. This study proposes the BSC quantitative estimation methodology to assess the performance of banks in India using Fuzzy Multiple Attribute Decision Making Methods (FMADM) [11].

The study aimed to determine the effects of BSC on the overall performance of service companies in Kakamega Municipality, Kenya, and the study project involved 200 people [12]. The stratified random sampling procedure was introduced with strata organized according to the nature of the services offered. After stratification, a simple random sampling was used to select respondent firms.

The study was designed to explore the relevance of BSC as a method for assessing performance in the Nigerian banking industry. 21 banks operating in Gombe state, Nigeria, participated in the study. A sampling technique was implemented based on a sampling of eleven (11) banks. Descriptive statistics and Kruskal–Wallis ANOVA were used as data analysis methods [13].

The main purpose of this study [14] is to empirically assess the impact of BI implementation on the organizational performance of banks. The conceptual model was developed based on the BSC. Data were collected through a questionnaire-based survey conducted manually in the universal banks of Ghana, where 130 samples of executives were analyzed using the structural equation modeling with partial least squares (PLS-SEM).

The objective [15] of the study is to develop a multi-criteria decision-making approach (MCDM) and BSC for evaluating the performance of three non-governmental Banks in Iran. According to the literature on banking performance and BSC concepts, experts and managers selected 21 indicators for the evaluation. Three MCDM analytical tools, such as TOPSIS, VIKOR and ELECTRE, have been implemented to rank bank indicators. This suggested fuzzy MCDM method, when combined with the BSC approach, is a comprehensive and modern model that can serve as a useful and effective assessment tool. Multiple regression analysis is used [16]. Among the eight selected indicators, the emphasis is placed on “net cash”, “flow”, which have a significant impact in improving the two performance measurements: both sustainability and extension of coverage. The latter also depends on the emphasis on "zero collateral to loan value ratio" in performance reporting. A structural assessment is proposed to link a key performance indicator in a strategic map based on the BSC for manufacturing industry in Indonesia [17]. The Decision Making Trial and Evaluation Laboratory (DEMATEL) method was used to identify critical central and influencing factors to determine cause–effect relations and to map out a visual strategy for enhancing corporate sustainability.

The TOPSIS method was applied for the multi-criteria assessment of various delivery options [18]. The author identified four main types of distributions in the selected online store and evaluated them using nine assessment criteria. The main idea of the TOPSIS method is to determine the positive and negative ideal values of weighted normalized decisions for criterions.

The author suggests developing an effective commercial strategy in an airline using a tool called a balanced scorecard [19]. An important stage in the formation of the strategy is the competitive advantages of the airline associated with the services provided. It is offered to use the indicator of "management efficiency" or "profitability of sales" as a general criterion of the strategy. As a result of the study, the author concludes that the profitability and viability of the strategy is confirmed by the long term operation of the business, as well as the satisfactory profitability of the company. This requires some knowledge about the processes of air transportation. The author suggests the following subprocesses that are necessary for the implementation of the company's strategy:

- developing a strategic vision, and define a mission;
- conducting a SWOT analysis;
- defining the airline's goals;
- defining and implementing programs; and
- controlling and creating feedback.

The authors considered various methods of calculating performance in Russian and foreign airlines [20]. The introduction of a Balanced Scorecard was proposed as one of the methods. The authors assessed the economic efficiency of its implementation. They proposed monitoring, identifying and

carrying out measures to improve productivity at Aeroflot by establishing a critical and target for each indicator.

4. METHODOLOGY RESEARCH

4.1. Integration of the Analytical Hierarchy Process (AHP) with the Fuzzy Analytical Hierarchy Process (FAHP)

To evaluate and select the most effective indicators for AirAstana, we suggest using the Integrated Analytic Hierarchy Process (AHP) and the Fuzzy Analytic Hierarchy Process (FAHP).

AHP was developed by the American scientist T.Saaty in 1970 [21]. It is one of the qualitative methods of the scenario analysis methodology and the multi-criteria and multi-objective expert method for determining the relative weights or priorities of alternative solutions. This method is used in many areas of decision making, in particular, for the solution of problems of choice, resource allocation, evaluation, income/cost ratio analysis, forecasting and planning [22-24].

However, the proposed classic AHP has many limitations, which were mentioned by the author, as well as by other authors [25]. One of the most significant shortcomings is the ability to process only point expert estimates. This is mostly unacceptable for practical tasks, which are characterized by conceptual uncertainty and multifactorial risks. Consequently, it essentially reduces the scope of application of AHP in solving practical problems, characterized by uncertainty and incompleteness of information on the objects or processes under study.

Due to these shortcomings, some researchers suggested that AHP should be integrated with other alternative methods of hierarchy analysis. The following methods can be highlighted among them: fuzzy expert estimates (the fuzzy hierarchy analysis process developed by Buckley [26]), the triangulation method of Chang, triangulation fuzzy numbers, the fuzzy Delphi method, the the consistency index, the fuzzy Topsis method presented by Hwang and Yoon [27] and multi-criteria aggregation methods - Fuzzy AHP, AHP-PROMETHEE, Dematel and others [28].

In this paper, AHP is integrated with the the Fuzzy Analytic Hierarchy Process (FAHP) to define an accurate estimate of "efficiency" values for the indicators examined. This method is interesting because of the variety of methods used to calculate the weights of indicators (perspectives).

4.2 Research on the construction of BSC using the integrated Fuzzy method of analysis of hierarchies

The method consists of 2 approaches:

The first approach is to conduct research for perspectives.

The second approach is for indicators.

Each approach includes the following steps (Fig 1). We will review steps 1.1; 2.1; 2.2; 2.3; 2.4; 2.5; 2.5.1; 2.5.1.2; and 2.5.1.3.

Stage 1.1. Based on expert assessments, a qualitative analysis of perspectives (indicators) is carried out, and a pairwise comparison matrix (PCM) ($\tilde{a}_{ji}$) is constructed by the analytical hierarchy process (AHP) [21, p. 29]. A pairwise comparison matrix is as follows:

$$A = \left(a_{ij}\right) = \begin{matrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{matrix} . \quad (1)$$

In the process of filling the matrix, if the indicator (prospect) A_i is more important than the indicator (prospect) A_j, then, the cell (A_i and A_j) corresponding to row i and column j is filled with an integer, and the cell (j, i) corresponding to row *j* and column *i* is filled with the inverse number (fraction) [21, p. 27].

$$a_{ij} = 1, \ \tilde{a}_{ji} = 1/\tilde{a}_{ij} . \quad (2)$$

Further, the remaining stages of the AHP are not calculated; instead, integration with the FAHP takes place (Fig. 1).

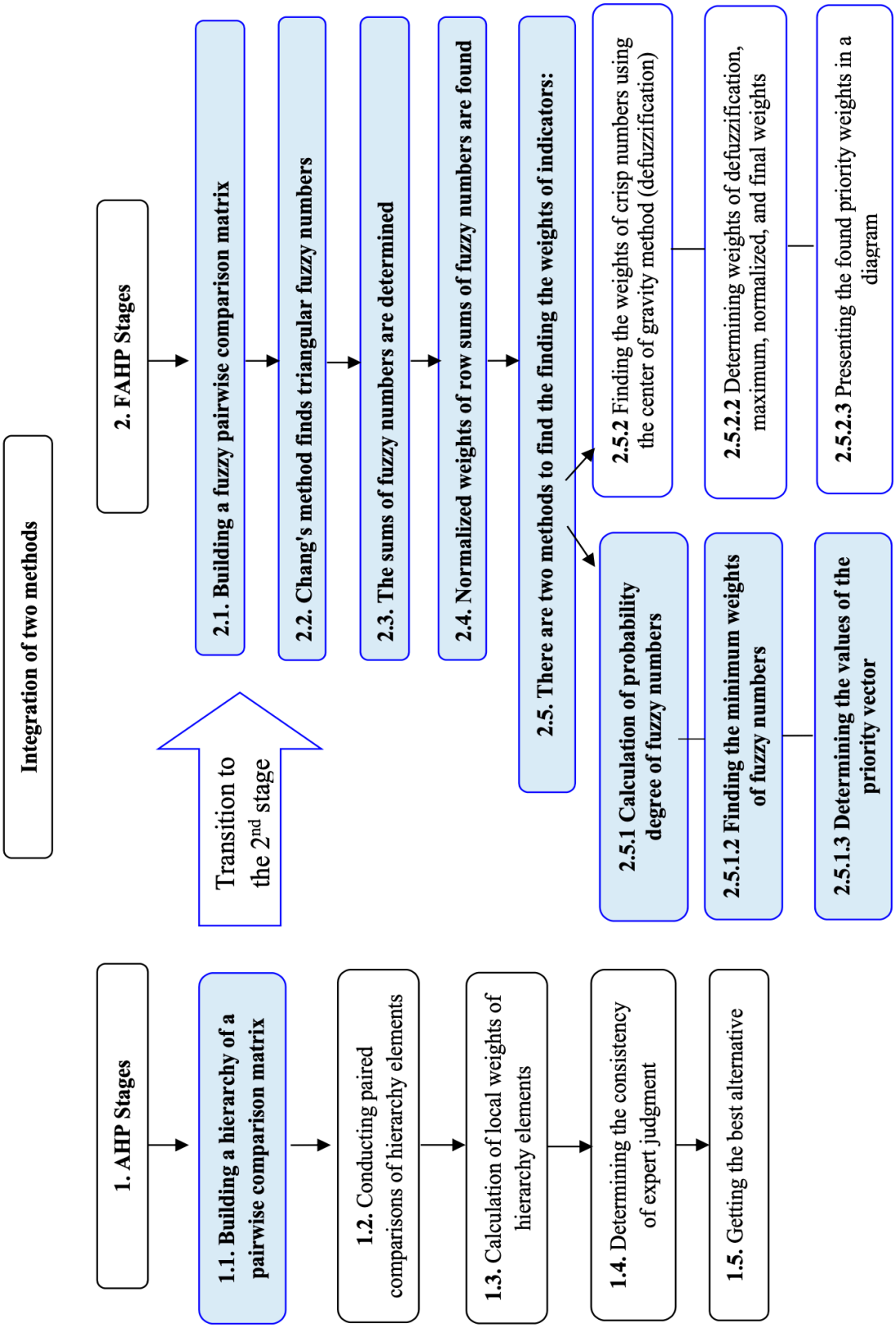

Fig. 1. AHP integration with FAHP
Source: Compiled by authors [26-28]

Stage 2.1. Due to the lack of AHP, at the second stage, we construct a fuzzy pairwise comparison matrix (FPCM). To construct an FPCM, the elements of the AHP matrix are replaced by fuzzy triangular numbers (FTN) (l, m, u) (which are in a triangular fuzzy form) proposed by Chang in 1992. Preparation of a problem for solving by fuzzy logic methods (fuzzification)[1] allows us to convert the real values of variables into fuzzy ones [29].

Stage 2.2. To construct the FAHP, the elements of the AHP matrix are replaced with fuzzy triangular numbers (FTN) (l, m, u), which is a rectangular matrix of dimensionality [n x 3n] [30]:

$$\tilde{A} = \tilde{a}_{ij} = \begin{pmatrix} (1,1,1) & (l_{12}, m_{12}, u_{12}) \cdots & (l_{1n}, m_{1n,} u_{1n}) \\ (l_{21,} m_{21}, u_{21}) & (1,1,1) \cdots & (l_{2n}, m_{2n}, u_{2n}) \\ (l_{n1}, m_{n1}, u_{n1}) & (l_{n2}, m_{n2}, u_{n3}) \cdots & (1,1,1) \end{pmatrix} . \quad (3)$$

The inverse symmetric elements of the FAHP are calculated using formula 4 [30, p. 651]:

$$\tilde{a}_{ji} = 1/\tilde{a}_{ij} = (1/l_{ij}, 1/m_{ij}, 1/u_{ij} \quad . \quad (4)$$

Fuzzy triangular numbers are denoted by the initial letters of the words "low" (*l*), "medium" (*m*) and "up" (*u*), which stand for low number value, middle number value and high number value respectively. For constructing the FPCM, experts use a fuzzy scale of the relative importance of indicators (triangular fuzzy scale).

Stage 2.3. The sums of fuzzy numbers (l,m,u) are determined from the rows of matrix $\widetilde{A}$ (formula 5) [31]:

$$(\sum_{j=1}^{n} l_{ij}, \sum_{j=1}^{n} m_{ij}, \sum_{j=1}^{n} u_{ij}), \qquad i = \overline{1,n}; \quad (5)$$

Stage 2.4. Normalized weights of row sums of fuzzy numbers are found (formula 6) [29, p. 2153]:

$$\widetilde{S_\iota} = \left(\frac{\sum_{j=1}^{n} l_{ij,}}{\sum_{j=1}^{n}\sum_{j=1}^{m} u_{ij}}, \frac{\sum_{j=1}^{n} m_{ij,}}{\sum_{j=1}^{n}\sum_{j=1}^{m} m_{ij}}, \frac{\sum_{j=1}^{n} u_{ij,}}{\sum_{j=1}^{n}\sum_{j=1}^{m} l_{ij}} \right), i = \overline{1,n}; \quad (6)$$

Stage 2.5. Determining weights for indicators (perspectives) is the most important and meaningful step. In this step, the researcher decides which indicators are of higher priority than the others, which determines the type of solution in the last analysis. Methods of obtaining weights or local priorities vector from fuzzy PCM (Pairwise Comparison Matrix) can be classified by two methods.

The following steps are performed based on the first method.

2.5.1. The probability degree that $S_i \geq S_j; i, j = \overline{1,n}; i \neq j$ by an equation (formula 7) [31, p.2154] is calculated:

$$V(\widetilde{S_\iota} \geq \widetilde{S_j}) = \begin{cases} 1, \ if \ m_i \geq m_j \\ 0, \ if \ l_j \geq u_i \\ \dfrac{l_j - u_i}{(m_i - u_i) - (m_j - l_j)}, else \end{cases} \quad (7)$$

2.5.1.2. The probability degree is calculated using formula 8 that S_i is preferable than all other fuzzy numbers [30, p. 653]:

$$\left(\widetilde{S_\iota} \geq \widetilde{S_J} \middle| \ j = 1, \dots n; j \neq i\right)| = \min V(\widetilde{S_\iota} \geq \widetilde{S_j}), = 1 \dots n; \quad (8)$$

2.5.1.3. The values of the priority vector are determined using formula 9 [30, p. 654]:

$$w_i \frac{V\left(\widetilde{S_\iota} \geq \widetilde{S_J} \middle| \ j = 1, \dots n; j \neq i\right)}{\sum_{i=1}^{n} V\left(\widetilde{S_\iota} \geq \widetilde{S_J} \middle| \ j = 1, \dots n; j \neq i\right)} \quad . \quad (9)$$

The second method was used [32].

[1] Fuzzification is the conversion of real values of variables into fuzzy numbers [29].

5. MODEL RESEARCH

5.1. The first stage is the determination of perspectives' importance

Stage 1.1. Based on the company's annual reports, 36 indicators were identified. The indicators were sorted into four perspectives in equal amounts. For effective control over the indicators, their number should be in the range 20-25 according to the method of Norton and Kaplan [2]. The expert assessment consisted of conducting a pairwise comparison of 36 indicators and 4 prospects using T. Saati's quantitative scale. The results of the pairwise comparison of experts are presented in Table 1.

Table 1

Results of expert assessments in pairwise comparison of prospects

Finance	**experts**						**average score**
	1	2	3	4	5	6	
Customers	1/3	1	1/3	1/5	1/3	1/5	0,3
Internal Processes	5	3	5	7	5	5	5
Learning and growth	9	7	7	5	5	7	6,6

Customers	**experts**						**average score**
	1	2	3	4	5	6	
Finance	3	1	3	5	3	5	3,3
Internal Processes	7	9	7	7	5	7	7
Learning and growth	7	7	7	9	5	7	7

Internal Processes	**experts**						**average score**
	1	2	3	4	5	6	
Finance	1/5	1/3	1/5	1/7	1/5	1/5	0,2
Customers	1/7	1/9	1/7	1/7	1/5	1/5	0,14
Learning and growth	3	5	3	3	3	3	3,3

Learning and growth	**experts**						**average score**
	1	2	3	4	5	6	
Finance	1/9	1/7	1/7	1/5	1/5	1/7	0,14
Customers	1/7	1/7	1/7	1/9	1/5	1/7	0,14
Internal Processes	1/3	1/5	1/3	1/3	1/3	1/3	0,33

Based on the average score of the experts, a matrix of paired comparisons is further constructed, which is determined by formulas (1) and (2) (see Table 2).

Table 2

Pairwise Comparison Matrix of perspectives

Criteria	Finance	Customers	Internal processes	Learning and growth
Finance	**1**	0,33	5	7
Customers	3	**1**	7	7
Internal processes	0,2	0,14285714	**1**	3
Learning and growth	0,14285714	0,14285714	0,333333	**1**

Source: Compiled by authors.

Stages 2.1 and 2.2. A fuzzy pairwise comparison matrix (FPCM) was constructed based on the FAHP based on formulas (3) and (4) (Table 3).

Table 3

A fuzzy pairwise comparison matrix

Criteria	**Finance**			**Customers**			**Internal Processes**			**Learning and growth**		
Finance	**1**	**1**	**1**	0,5	0,67	1	1,5	2	2,5	2	2,5	3
Customers	1	1,5	2	**1**	**1**	**1**	2	2,5	3	2	2,5	3
Internal processes	0,4	0,5	0,67	0,33	0,4	0,5	**1**	**1**	**1**	1	1,5	2
Learning and growth	0,33	0,4	0,5	0,33	0,4	0,5	0,5	0,67	1	**1**	**1**	**1**

Source: Compiled by authors.

Stage 2.3. We calculated the sum of the fuzzy numbers on the rows of the matrix according to formula (5), which are presented in Table 4.

Table 4

Triangular fuzzy numbers

Criteria	**l**	**m**	**u**
Finance	5,00	6,17	7,50
Customers	6,00	7,50	9,00
Internal Processes	2,73	3,40	4,17
Learning and growth	2,17	2,47	3,00
Sum	**15,90**	**19,53**	**23,67**

Source: Compiled by authors.

Stage 2.4. The calculated normalized weights of the row sums of fuzzy numbers by (6) are presented in Table 5.

Table 5

Normalized weights of row sums of fuzzy numbers

Criteria	**l**	**m**	**u**
Finance	0,211267606	0,315699659	0,471698113
Customers	0,253521127	0,383959044	0,566037736
Internal Processes	0,115492958	0,174061433	0,262054507
Learning and growth	0,091549296	0,126279863	0,188679245

Source: Compiled by authors.

Stage 2.5.

2.5.1. Therefore, the degree of probability was calculated using formula (7) **(**Table 6).

Table 6

The degree of probability

Criteria	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$
Finance	**1**	1	0,263931	0
Customers	0,761694	**1**	0,039067	0
Internal Processes	1	1	**1**	0,605006
Learning and growth	1	1	1	**1**

Source: Compiled by authors.

2.5.1.2 and 2.5.1.3. We calculated the degree of probability that S_i is preferable to all other fuzzy numbers (8) and determined the priority vector using formula (9) (Table 7).

The results of the 6th Table show that the most important priority is the "Customers" perspective with a normalized weight of 0.555. The "Finance" perspective with a weight of 0.423 is at the second place by priority. The perspective of "Internal processes" with a normalized weight of 0.021 is at the third place. The lowest weight is 0 for the perspective of "Learning and Growth".

Table 7

Minimum values of fuzzy numbers and weight of priorities of perspectives

Criteria	l	m	u	min	w
Finance	0,761694	1	1	0,761694	0,422985
Customers	1	1	1	1	**0,555321**
Internal Processes	0,263931	0,039067	1	0,039067	0,021695
Learning and growth	0	0	0,605006	0	0
			Sum	1,800761	1

Source: Compiled by authors.

5.2. The second stage is the determination of the importance of the indicators

Stages 1.1 to 2.5 are calculated similarly to the first approach. Therefore, we just show calculations of 2.5.1; 2.5.1.2; and 2.5.1.3.th stages for the *"Customers"* perspective, the vector of priority indicators (Fig. 1).

Calculation of indicators for the "Customers" perspective.

Stage 2.5.

2.5.1. The degree of probability is calculated using formula (7) (Table 8).

2.5.1.2 and 2.5.1.3. We calculated the degree of probability that S_i is preferable to all other fuzzy numbers using formula (8) and determined the priority vector using formula (9) (Table 9).

The results of Table 9 show that the highest-priority indicators are passenger satisfaction (0.153), number of passengers with a Nomad Club bonus card (0.113), ASK (0.106), code-sharing agreements (0.162) and number of passengers (0.159).

Similar calculations were carried out for the perspectives *"Internal Process", "Learning and Growth" and "Finance"* according to the stages.

The analysis of the results for the *"Internal Process"* perspective showed that the highest-priority indicators are average number of aircraft (0.150), on-time Performance (0.126), technical dispatch reliability (0.155), number of accidents (0.152), fleet average age (0.173) and level of safety (0.152).

For the *"Learning and Growth"* perspective, the highest-priority indicators are employee satisfaction (0.174), percentage of qualified employees from the total number of employees (0.170), amount of funds for training (0.156), the number of passengers buying tickets through websites (0.144), IT costs (0.122) and employee efficiency (0.168).

The results of calculation for the *"Finance"* perspective showed that the highest-priority indicators are revenue with a weight of 0.149, EBITDAR (0.124), ROIC (0.142), profitability (0.155) and operating costs with a weight of 0.138. The weight values of indicators below 0.1 has low priority.

6. CONCLUSIONS

During the study, using the integrated AHP and FAHP allowed the selection of 22 effective indicators from the proposed 36 indicators. The results of the study show that such indicators as passenger satisfaction, code-sharing agreements with airlines, total number of passengers, Available Seat Kilometers (ASK) and number of passengers with a bonus card are the most effective for the "Customers" perspective. Accordingly, profitability, revenue, operating costs, ROIC and EBITDAR turned out to be the most important indicators for the financial perspective. Such indicators as the fleet average age, technical dispatch reliability, on-time Performance and number of accidents, level of safety and the average number of aircraft are the most important for the "Internal processes" perspective. The indicators such as employee satisfaction, employee efficiency, percentage of qualified employees from

the total number of employees, amount of funds for training, the number of passengers buying tickets through websites and IT costs are the most effective indicators for the "Learning and growth" perspective. Based on the selected indicators, the company will be able to monitor the effectiveness of its activities.

Table 8

The degree of probability

Indicators	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$	$\mathbf{m_i \geq m_j}$
passenger satisfaction	**1**	0,625684	0,268906	0,433489	0,339375	0,568048	0,49801	1	0,9379
Nomad Club members	1	**1**	0,656909	0,803458	0,711479	0,940376	0,872623	1	1
the company share	1	1	**1**	1	1	1	1	1	1
the passenger load factor	1	1	0,868425	**1**	1	1	1	1	1
segments	1	1	0,964967	1,086393	**1**	1	1	1	1
Available Seat Kilometers	1	1	0,718235	0,861998	0,769964	**1**	0,932396	1	1
flight hours	1	1	0,792816	0,929584	0,839579	1	**1**	1	1
code-sharing agreements	0,837583	0,459453	0,099895	0,269661	0,175289	0,402772	0,332258	**1**	1
number of passengers	1	0,684465	0,323036	0,488556	0,392985	0,625667	0,554798	1	1

Source: Compiled by authors.

Table 9

Minimum values of fuzzy numbers and weight priority indicators

Indicators	**l**	**m**	**u**	**min**	$\mathbf{W_i}$	
passenger satisfaction	1	1	1	1	0,053964	**0,153127**
	1	1	1	1	0,053964	
	1	0,837583	1	0,837583	0,045199	
Nomad Club members	0,625684	1	1	0,625684	0,033764	**0,112522**
	1	1	1	1	0,053964	
	1	0,459453	0,684465	0,459453	0,024794	
the company share	0,268906	0,656909	1	0,268906	0,014511	0,058661
	0,868425	0,964967	0,718235	0,718235	0,038759	
	0,792816	0,099895	0,323036	0,099895	0,005391	
the passenger load factor	0,433489	0,803458	1	0,433489	0,023393	0,084461
	1	1,086393	0,861998	0,861998	0,046517	
	0,929584	0,269661	0,488556	0,269661	0,014552	
segments	0,339375	0,711479	1	0,339375	0,018314	0,069323
	1	1	0,769964	0,769964	0,04155	
	0,839579	0,175289	0,392985	0,175289	0,009459	
Available Seat Kilometers (ASK)	0,568048	0,940376	1	0,568048	0,030654	**0,106353**
	1	1	1	1	0,053964	
	1	0,402772	0,625667	0,402772	0,021735	
flight hours	0,49801	0,872623	1	0,49801	0,026875	0,09512
	1	1	0,932396	0,932396	0,050316	
	1	0,332258	0,554798	0,332258	0,01793	
code-sharing agreements	1	1	1	1	0,053964	**0,161891**
	1	1	1	1	0,053964	
	1	1	1	1	0,053964	
number of passengers	0,937924	1	1	0,937924	0,050614	**0,158542**
	1	1	1	1	0,053964	
	1	1	1	1	0,053964	
			Sum	**18,53094**	**1**	**1**

Source: Compiled by authors.

The proposed methodology for the selection of performance indicators will act as a tool for measuring the effectiveness of achieving the strategic goals, and will promote effective management of the airline, taking into account the peculiarities of the construction of its basic processes. It can also be used for the management of various companies to increase the efficiency of management decisions.

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