Performance measurement systems evaluation

"An applied study of Libyan Airlines company."

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Abstract **- Performance measure is the historical development of the performance control, which focuses on the quality-of-service delivery and the achievement of goals that the organization seeks to achieve. Since the institution is in a constant state of change due to the changing environment constantly, this requires the continuous adjustment of its plans, policies and decisions, according to the practiced evaluation processes based on the previously prepared plan in the hope to discover the strengths and weaknesses points. This evaluation can be made for the organization based on pre-defined criteria.**

The aim of this research is to evaluate the performance measurement system in one of the biggest air transport companies in Libya "Libyan Arab Airlines". The researcher has used the descriptive analytical method and specific questionnaire was designed to collect the data. Fifty Questionnaires were distributed for random samples, forty-seven of which have been collected as feedback (88% of the distributed questionnaires).

The results showed that the indicators of the performance measurements were present in the Libyan Airlines Company but sometimes they are not measured. Despite of the presence of items concerned with the customer satisfaction, operations field and the achievements of the company's stakeholders objectives as indicators within the company, but they are not applied. Indicators concerned with safety and environment exist and frequently applied.

Based on the findings of the researcher, it is recommended for the Libyan Arab Airlines Company to build proper foundations for performance evaluation through the development of a strategy for the company through which to achieve the set objectives. Without strategic systems the company does not have intellectual and philosophical framework to be followed. It is also necessary to develop performance measurement and evaluation systems, and re-examine on a regular basis in the criteria used for performance evaluation, and these standards will have to be modified and updated periodically to fit in with any changes in the surrounding environment so that whenever there have been changes in the area around the company's business environment, it took the need to amend the criteria used to fit those changes.

Keywords—**Performance, Reliability, IATA,ICAO .**

1- INTRODUCTION

Organizations need a tool through which they can assess the effectiveness of the activities and processes necessary to achieve their desired goals and determine any variances between the targeted and actual results.

Organizations also need to measure their performance or management from time to time, regardless of personal benefit and financial returns. The information obtained can improve the performance of the organization. When you can measure and express what you are talking about in numbers, it means that you know something about it. But when you are unable to measure and express it in numbers, your knowledge will be limited and unsatisfactory. In that case, your understanding may be only the beginning, but you are unlikely to progress in your ideas and reach the stage of knowledge. If the organization cannot measure its activity, it cannot control it. And if it cannot control it, it cannot manage it. Without measurement, it is impossible to make sound decisions.

The criteria itself cannot be useful in most cases unless it is compared to a similar criterion in a way that measures the progress of the current situation of the organization compared to the situation in previous years.

The difficulties that organizations face today are in aligning performance measurement systems with the strategy, structure, and culture of the institution. It is necessary to choose the type and number of criteria s to be used so that they are compatible with any changes that occur in the surrounding environment. The more changes occur, the more important it is to adapt the performance measurement systems to ensure their relevance and effectiveness.

In the business environment surrounding the institution, it is necessary to adjust the standards used to align with those changes.

2- PERFORMANCE MEASUREMENT PROGRAMS USED IN THE MAINTENANCE DEPARTMENT IN THE PLANNING AND ENGINEERING DEPARTMENT

Given the current difficult circumstances and the privacy of the phase that the company is going through (where internal events and security instability are accompanying several problems related to the aviation sector, including losses in aircraft since 2014), the researcher conducted interviews with competent and experienced engineers in the sector to develop methods for measuring performance for some

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technical indicators aimed at raising the level of quality and performance, including the following:

2.1 *Program of reliability*

The concept of reliability in the aviation industry involves a set of rules and practices to manage and monitor maintenance programs. There are two main approaches to the concept of reliability in aviation. The first approach focuses on company-wide operations and measures dispatch reliability, which is concerned with the success of the airline in adhering to scheduled takeoffs. This approach focuses on measuring and monitoring delays and their causes, whether they are technical or other reasons. The other approach to reliability is known as primary reliability. This approach focuses on monitoring maintenance issues that cause delays by analyzing data and taking corrective actions to prevent these issues from recurring.

3- PERFORMANCE MEASUREMENT SYSTEMS IN AIRLINE COMPANIES

3.1 Safety Management System

Based on ICAO requirements, the organization must establish an integrated safety management system that includes regulatory rules and instructions to ensure the safety of operations from the perspective of aircraft and airport operators, aircraft maintenance (ATS) providers, and air traffic service providers. It also includes provisions for various activities, such as reporting incidents, safety investigations, safety audits, and encouragement of safety practices. [1]

3.2 Security Management System

The International Air Transport Association (IATA) has adopted an approach to ensure that all its member airlines adopt security management systems in their operations. Security management is now a mandatory requirement for IATA members through the operational safety audit conducted by IATA. [2].

3.3 Environmental Management System

The International Civil Aviation Organization has made significant efforts to reduce and mitigate the negative impact of aviation activities on the environment through the development and implementation of policies and programs aimed at protecting the environment. The organization has requested that contracting states develop their own action plans to address emissions resulting from the aviation sector. [3].

3.4 Quality Management system

To build an integrated system that meets the requirements of keeping up with continuous changes and makes the continuous improvement process responsive to the internal and external conditions affecting the organization with effectiveness and efficiency. This is what the ISO 9001:2015 Quality Management System aims to achieve.

4- THE FIRST TOPIC: MEASURING THE OPERATIONAL PERFORMANCE RATE OF THE FLEET IN THE COMPANY.

That maintenance requirements and programs vary from one aircraft to another, controlled by factors such as the type of operation (commercial, training, firefighting, etc.) and the climate at the main base of operations. Each aircraft manufacturer issues a maintenance manual with the sold aircraft, and there are guides for major overhauls and other details. The responsibility for setting maintenance programs does not solely fall on the manufacturer, but rather the civil aviation authority of the state shares the responsibility with them. When an aircraft enters the operating market, the opinions and experiences of airlines or aircraft operators are taken into account. As for the timing of maintenance, it is based on the time elapsed since the start of operation or the last previous maintenance operation. Actual operating hours, the number of takeoffs and landings, and the designated service life of the aircraft are taken into consideration. Operational performance for aircraft is measured daily and includes both scheduled and unscheduled maintenance. Performance is measured at a certain number of aircraft, where five (5) aircraft of the same type are present. There are two types of aircraft for which performance is calculated: the first type is CRJ900 and the second type is AIRBUS. Due to the events that the company went through in 2014 and the withdrawal of many aircraft from service, this program was suspended until a number of aircraft returned from maintenance and resumed operation.

4.1 The equations used in data calculations

1- The average trip duration (in hours or as a percentage) = the total time spent on all trips / the number of trips.
2- Daily utilization (hours, percentage) = Total flight time/ number of days/number of aircraft
3- Schedule adherence = Total delay time/number of flights
4- Delay percentage = (number of flights - (cancelled flights + delayed flights)) x 100/number of flights
5- Accident rate per 1000 flight hours = (number of accidents x 1000) / flight hours
6- Captain's report rate = (number of reports x 100 flight hours
7- Maintenance report rate = (number of reports x 100 flight hours

4.2 The operational performance measurement for the CRJ 900 fleet.

The company is interested in measuring the operational performance rate of its fleet in order to determine the timing of technical inspections and to identify the reasons for delays,

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which are divided into technical and non-technical reasons. The technical reasons must pass 15 minutes, and it is also necessary to know the available spare parts that need to be replaced, where specialized parties are contacted to determine this.

The researcher conducted interviews with a group of competent engineers in the relevant field, and it was found that the Planning and Engineering Department issues a monthly and annual report to clarify the overall performance rate of the fleet for each type of aircraft, which is produced by collecting daily data by specialized engineers as shown in tables (1-2). The report includes calculating the total flight hours for each month, the total number of takeoffs and landings, the number of canceled and delayed flights, and mentioning the reasons. The report is then submitted to the technical department for discussion.

TABLE (1,2)
The source: The annual report of the accreditation authority for the type of aircraft.

Aircraft Type	Aircraft Series	A/C S/N	Month	Flight Hours-Month	Cycles-Month	Flight Hours-Cum	Cycles-Cum	APU Hours-Month	APU Cycles-Month
CRJ900	LAA	15120	Jan-14	0	0	9556.55	7318		
CRJ900	LAB	15121	Jan-14	141	132	9589.11	7099		
CRJ900	LAC	15122	Jan-14	175	145	9421.11	7157		
CRJ900	LAD	15214	Jan-14	164	139	7589.15	5793		
CRJ900	LAE	15216	Jan-14	0	0	4763.01	3262		
CRJ900	LAL	15256	Jan-14	83	75	3794.21	3606		
CRJ900	LAM	15257	Jan-14	171	140	3992.56	3678		
CRJ900	LAN	15258	Jan-14	136	143	3031.02	2922		

Aircraft Series	Date	Airport Code	Flight Number	Scheduled departure time	Actual departure time	Dly/ Cnx	Delay Time (mins) or Cancellation	ATA	Delay reason	Corrective Action
5A-LAD	04.11.2014	TIP	LN684	06:15	10:55	DLY	280	3273	MAIN WHEEL NO.01 & 2 WORN TO LIMIT DUE TO RH SENSOR HEATER FAILED	MAIN WHEEL NO.01 & 2 REPLACED ACC AMM 32-41-01-001-400-801-A03REV43 TESATED ACC FIM 73-21-00-810-807CONFIG A01
5A-LAL	11.11.2014	TIP	LN606	14:30	15:30	DLY	01:00	32	A/w swap 5A-LAM AOG due to M/G strut leak	
5A-LAN	11.11.2014	TIP	LN926	10:00	10:35	DLY	00:35	52	PAX DR OUT HANDL COMES ON # OFF DURING FLT	PAX DOOR DROX SENSOR PX107 CHANGED TASK 52-70-04-400-807-REV43
5A-LAL	03.11.2013	TIP	LN816	06:00	06:55	DLY	00:55	32	NOSE WHEEL NO.01WORN TO LIMIT	NOSE WHEEL NO.01 CHANGED ACC AMM 32-42-01-400-801REV42
								32	NOSE WHEEL NO.02 WORN TO LIMIT	NOSE WHEEL NO.02 CHANGED ACC AMM 32-42-01-400-801REV42
5A-LAC	03.11.2014	TIP	LN696	06:00	07:50	DLY	01:50	5	Eng# Run Up	
5A-LAL	24.11.2014	TIP	LN604	12:15	15:30	DLY	03:15	52	FWD CARGO DOOR SENSOR PX16 INTERMITTENT CAUSES PROX FAULT 2 STATUS	DMI OPENED UNTIL 4/12/2013

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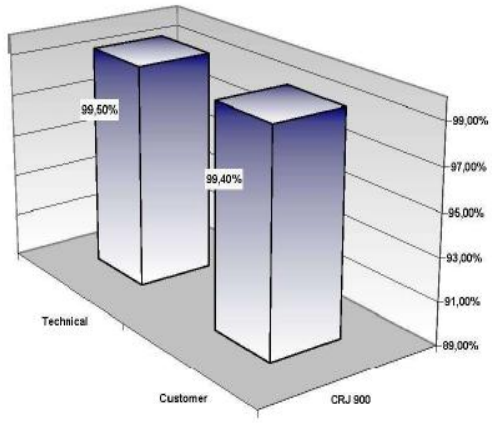
4.3 Comparison of the technical accreditation achievements of the company

The graph illustrates the percentage of completed flights per month compared to the scheduled monthly flight table for this model (CRJ900). It is noticeable that the technical side's commitment rate to ensuring aircraft depart on time has increased to between 89-99.8%.

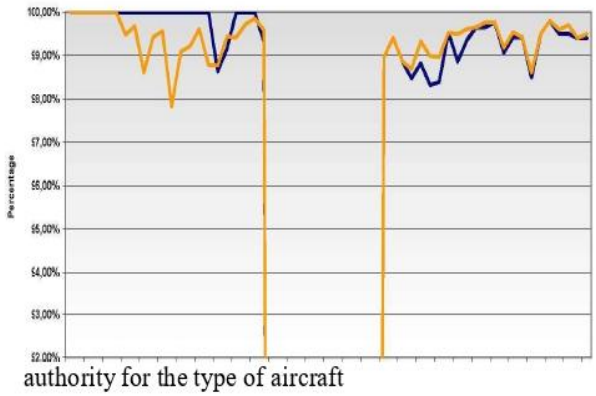


FIG(1) The source: The annual report of the accreditation authority for the type of aircraft.

4.4 The actual rates of technical accreditation for thecompany

The percentage of delayed flights due to technical malfunctions in relation to the total number of flights, expressed as a percentage. Delays caused by other factors are not taken into account. Through the graph, we find that the percentage is very similar between the technically determined rate and the rate resulting from the company. The reason for this is that the company has a fleet of modern aircraft

FIG(2) The source: The annual report of the accreditation



authority for the type of aircraft

5 .Measuring the operational performance of the A320-214 fleet during the year 2015.

5.1 measuring flight hours

From the table and fig(3,3), we notice that the number of scheduled flights is slightly higher than the actual number of flights, as the scheduled flights for January, for example, were 340 while the actual flights were 337. The reason for this could be related to safety, as the aircraft manufacturer sets specific times and hours for flight to change some parts or units of the aircraft. For example, there are aircraft that have some parts changed after 500 hours of flight, while others have parts changed after 1000 hours of flight.

TABLE 3
The annual report for the AIRBUS A320 aircraft type

DATE	A/C N°	B/B	A/B	OPER A/B	CYCLES	FLIGHTS	OPER FLIGHT	Daily use	Average leg
06/2015	3	617	527	520	317	317	313	5.85	1.67
05/2015	3	675	578	575	333	333	332	6.21	1.73
04/2015	3	670	572	566	334	334	332	6.35	1.71
03/2015	3	687	592	572	345	345	331	6.36	1.71
02/2015	3	548	471	468	276	276	274	5.60	1.70
01/2015	3	292	597	594	340	340	337	6.42	1.74

accreditation for the year 2015"

FIG3 The annual report for the AIRBUS A320 aircraft type accreditation for the year 2015

5.2 Measurement of Flight Cycles

We notice from FIG (4) that the number of descents and ascents are close to each other.

FIG4 The annual report for the AIRBUS A320 aircraft type accreditation for the year 2015

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5.3 The average rate of pilot reports compared tomaintenance reports

The data in table (4) and the corresponding FIG (5) demonstrate the ratio between reports generated by pilots and those generated by maintenance. This measure is used to improve performance, reduce problems, and prevent their occurrence by addressing their root causes.

TABLE 4 The annual report for the AIRBUS A320 aircraft type accreditation for the year 2015

DATE	PIREPS	MAREPS	MAREPS/PIREPS RATE
06/2015	17	47	2.76
05/2015	38	28	0.7
04/2015	15	43	2.87
03/2015	28	55	1.96
02/2015	23	52	2.26
01/2015	26	54	2.07
12/2014	9	81	9.0

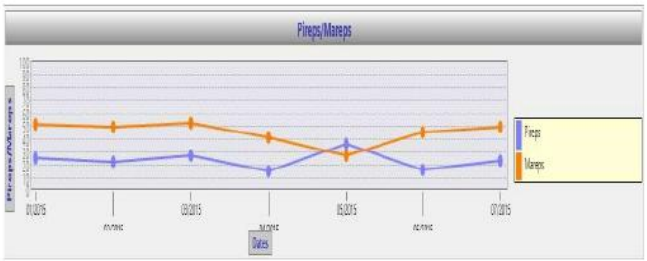

FIG5The annual report for the AIRBUS A320 aircraft type accreditation for the year 2015

The researcher's reports indicate that the reliability program is not functioning efficiently because the number of aircraft after 2014 is less than five. Therefore, the engineer cannot calculate the performance rate due to the lack of basic operating conditions. Unfortunately, the primary task has now become to operate flights under any circumstances.

6. Topic 2: Evaluating Performance Measurement Systems for the Company

6.1 The methodology of studying

Due to the nature of the objectives sought by this study in evaluating performance measurement systems in an airline company, specifically Libyan Airlines, the researcher used a descriptive approach in her survey style, which is suitable for the nature of this study. The descriptive approach is in line with the theoretical objective of identifying the concept of performance and performance measurement systems, while the analytical approach is in line with the practical objective of evaluating performance measurement systems in Libyan Airlines. The descriptive approach does not stop at collecting data and information related to the phenomenon in order to investigate its various aspects and relationships, but goes beyond to analyze and interpret the phenomenon and reach conclusions that contribute to developing and improving the reality.

6.2 study community and study sample.

Assuming that studying is a state, the community of study is represented by Libyan Airlines Tripoli, and due to the size of the community and the difficulty of accessing all its members, the survey method was used to collect data by taking a small random sample from the study community, consisting of general managers, department managers, and section heads. To ensure that the sample size was appropriate, a sample size of 50 individuals was chosen. It took one month to distribute the questionnaire, and the researcher was able to retrieve 47 completed and valid questionnaires for analysis, while 3 questionnaires were found to be invalid for analysis, with a retrieval rate of 88%, which is a good percentage.

6.3 study tool

A closed questionnaire has been designed as a tool to collect data from a study sample. It consists of several sections:

Part 1: General information, which includes personal characteristics of the respondent such as gender, age, educational qualification, years of experience, and managerial level.

Part 2: Data on the evaluation of performance measurement systems in the company, divided into two axes:

The first axis includes data related to the company's goals and objectives, consisting of 9 items.

The second axis includes data on identifying performance measurement indicators, which has been divided into several items as follows:

1- The area of customer satisfaction, consisting of 16 items.
2- The area of operations, consisting of 9 items.
3- The area of safety, consisting of 4 items.
4- The field of environment consists of (4) paragraphs.
5- The field of achieving stakeholders' goals in the company consists of (4) paragraphs.

Survey respondents are to answer the questionnaire paragraphs using a five-point Likert scale, where a continuous indicator is present and being measured, a four-point scale where an indicator is present but not continuously measured, a three-point scale where an indicator is present but not measured, two points are given for a scale where there is no indicator, and one point is given for a scale where there is no indicator and no measurement is taken. The mean average is considered to be equal to the number (3), as (1+2+3+4+5)/5=(3). Weight periods were calculated to determine the weighted average period for

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each opinion in the two axes, where the period used was (4/5=0.8), as shown in Table (6).

TABLE (6) The Likert Pentad Direction Determination Table according to Weighted Average.

weight	Expiration	Scal
1	An index is not adopted or measured	From 1 to 1.97
2	There is no indictor	From 1.8 to 2.59
3	There is indictor but not measured	From 2.60 to 3.39
4	There is indictor with measured but not always	From 3.40 to 4.19
5	There is indictor with always measured	From 4.20 to 5

6.4 Statistical Processing

Since the survey method was used to collect data in the study, descriptive statistical methods will be used to analyze the data, using the statistical package for social sciences to process the study data through the appropriate statistical method. [5] [4]:

1. Percentages, frequencies, and means: These are used primarily to determine the frequency of categories for a given variable and are useful for describing the sample.

2. Cronbach's Alpha test: This test measures the consistency of respondents' answers to all questions in the scale and the extent to which each question measures the same concept. The value of Cronbach's Alpha coefficient ranges from 0 to 1, indicating the degree of correlation between the responses of the study sample. A value of 0 indicates no absolute correlation between the responses, while a value of 1 indicates a complete correlation. The smallest acceptable value for Cronbach's Alpha is 0.6, while the best value ranges from 0.7 to 0.8. The higher the value is above 0.8, the better.

3- Standard deviation is used to measure the dispersion of answers and how far they deviate from their arithmetic mean. The smaller the deviation, the more the values are clustered around their arithmetic mean, meaning that the mean represents the total of the answers accurately. Standard deviation is calculated using the following equation.

$$S_x = \sqrt{\frac{\sum f x^2}{\sum f} - \bar{X}^2} \quad \text{.....(1)}$$

Where:

$\bar{X}$: The arithmetic mean.

f: The number of answers in the sample for each question.

x: The weight given to each answer.

The T-test is used in the case of a single sample to determine whether the average response score has reached the average score (3), or whether it has increased or decreased from it. The researcher used it to confirm the significance of the average for each question in the questionnaire.

The arithmetic mean is used to determine the degree of concentration of respondents' answers for each question around the scale scores. The weighted mean was calculated using the following equation:.

$$\bar{X} = \frac{\sum f x}{n}$$

f: Number of sample responses per item.
x: Weight given to each response.
n: Sample size.

8- CONCLUSION

This chapter aims to present the results of the field study in light of the theoretical framework, which evaluated the performance measurement systems at Libyan Airlines. The study aimed to provide recommendations that would help the company assess its performance, leading to improvement and development.

1. The results showed that there are documented and announced goals related to business, quality, safety, and the environment. However, the study revealed that employees do not understand the performance measurement systems that achieve these goals.

2. It was found that the customer satisfaction index exists but is not measured according to the opinions of the sample individuals. The company's policy regarding customer satisfaction needs a strategy to maintain its current customers and attract new ones. The study revealed complaints and problems related to delays in arrival and departure times for some flights, resulting from several reasons, including the handling company.

3. The results indicate that the operations performance index exists but is not measured according to the opinions of the

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sample individuals. Determining operational indicators more accurately is necessary for the company's performance to be good. It was found that the average age of the air transport fleet index exists and is measured, and that the available seat kilometers index and the development of the company's network by monitoring the offered seat kilometers are present but not measured.

4. The results showed that safety indicators are tracked to regional and global systems, and therefore, there is a commitment to measure them. The study revealed that all of the follow-up paragraphs for technical crews' time limits (flight hours, aviation authority, etc.), the number of violations recorded on the company's operations in a certain period, and the number of accidents recorded periodically are present and measured.

5- identifying environmental indicators such as smoking ban on airplanes and measuring them, as well as determining the age of aircraft to ensure compliance with the latest environmental legislation and measuring pollution from aircraft emissions and machinery in tons, is present and measured.

6- Through personal interviews with employees, it was found that frequent changes in the organizational structure and the establishment of new units without being based on organizational needs have led to the repetition of administrative processes, complicating procedures, and increasing the number of employees.

7- The difficulty in measuring the operational performance rate of the fleet is due to the operational conditions that the company and its supporting companies have experienced. The company lost most of its equipment, and the number became insufficient for operation. Additionally, the shortage of personnel and skills due to security conditions, the departure of expatriate personnel, and a lack of training contribute to this difficulty.

9-RECOMMENATION

Based on the findings and with the aim of improving performance and raising the efficiency of evaluation standards used by Libyan Airlines, as well as improving the quality of services provided by the company, the researcher recommends the following:

1- Emphasis on strategic concepts, as strategy is a managerial approach that plans for three axes: strengthening the position of the institution, meeting the needs of customers, and achieving strategic objectives. Without strategy, the institution lacks a framework of thought and philosophy to follow, nor even a roadmap or unified behavior program to achieve the desired results.

2- Focus on clear and measurable goals that can then provide an accurate description of the work required to achieve those goals, including responsibilities and functional obligations.

3- The need for an information management system capable of collecting, analyzing, documenting, and feeding information to relevant parties, from execution sites to decision-making centers, so that decision-makers can determine the achieved results and the extent of deviation from plans, negatively or positively. This information system also facilitates comparative measurements to determine the position of the institution in its market or the field in which it provides its services, and to compare it with its peers in the same market or other institutions.

4- Emphasis on employees, as morale, job satisfaction, turnover, and absenteeism are all directly influencing factors on the company's performance. Job satisfaction affects other elements such as absenteeism rate, understanding with employees, and reduced social problems, all of which are reflected in employee productivity. Additionally, the expertise and skills that employees must have are important factors in ensuring the quality of work performance, and any company must improve the efficiency of its workforce through training programs it develops and oversees, as training contributes to increased productivity and improved performance.

5- The need for a specialized department to improve technical and administrative performance within the company.

6- Developing a mechanism for setting standards and indicators, adopting them, documenting them, and mandating specialists at the executive levels to take necessary action to implement them, as well as a mechanism for monitoring whether these standards have been achieved or not.

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