Sudan University of Science and Technology

College Of Graduate Study

Total Quality Management & Excellence Center

The Impact of Implementation of IATA Operational Safety Audit Program (IOSA) on Aviation Safety in Airlines

**Sudan Airways Company (Ground Handling operation section)
as Case study**

تأثير تطبيق برنامج التدقيق الأيوسا على سلامة الطيران في الخطوط الجوية

بدراسة حالة الخطوط الجوية السودانية (قطاع المناولة الارضية)

M.Sc. degree of total quality management & Excellence

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بسم الله الرحمن الرحيم

قال تعالى :

آمَنَ الرَّسُولُ بِمَا أُنزِلَ إِلَيْهِ مِن رَّبِّهِ وَالْمُؤْمِنُونَ كُلٌّ آمَنَ بِاللَّهِ وَمَلَائِكَتِهِ وَكُتُبِهِ وَرُسُلِهِ لَا نُفَرِّقُ بَيْنَ أَحَدٍ مِّن رُّسُلِهِ وَقَالُوا سَمِعْنَا وَأَطَعْنَا غُفْرَانَكَ رَبَّنَا وَإِلَيْكَ الْمَصِيرُ لَا يُكَلِّفُ اللَّهُ نَفْسًا إِلَّا وُسْعَهَا لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَا إِن نَّسِينَا أَوْ أَخْطَأْنَا رَبَّنَا وَلَا تَحْمِلْ عَلَيْنَا إِصْرًا كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِن قَبْلِنَا رَبَّنَا وَلَا تُحَمِّلْنَا مَا لَا طَاقَةَ لَنَا بِهِ وَاعْفُ عَنَّا وَاغْفِرْ لَنَا وَارْحَمْنَا أَنتَ مَوْلَانَا فَانصُرْنَا عَلَى الْقَوْمِ الْكَافِرِينَ

صدق الله العظيم

سورة البقرة (285-286)

I

الإهــــــــــداء

الى ..

منسهر الليالي ... ونسي الغوالي ... وظل سندي الموالي ... وحمل همي غير مبالي

بدر التمام ... والدي الغالي

الى ....

مناثقلت الجفون سهرا ... وحملت الفؤاد هما ... وجاهدت الايام صبرا ... وشغلت البال

فكرا ... ورفعت الايادي دعاءا ... وايقنت بالله املا

اغلى الغوالي واحب الاحباب ... امي العزيزةالغالية

الى ..

ورود المحبة ... وينابيع الوفاء ... الى من رافقوني في السراءوالضراءاصدق الاصحاب ...اخواني

محمود،احمد، نمارق

الى ....

القلعة الحصينة... ...الأخوات اللواتي لم تلدهن أمي .. إلى من تحلو بالإخاء وتميزوا بالوفاء

والعطاء إلى ينابيع الصدق الصافي إلى من معهم سعدت ، وبرفقتهم في دروب الحياة الحلوة

والحزينة سرت إلى من كانوا معي على طريق النجاح والخير إلى من عرفت كيف أجدهم وعلموني

أن لا أضيعهم..صديقاتي

اسراء،جواهر،ريان،ابتسام،رزان،اسراء،اريج ،ميادة وروزانا

ACKNOWLEGEMENT:

ABSTRACT:

The research studies the impact of implementation of IATA Operational Safety Audit Program (IOSA) on Aviation Safety in Airlines.

The research takes Sudan airways as Case study; Ground Handling operation ssection which its activities include:Passenger handling, Baggage handling, Aircraft handling and loading and Load control.

The research examines the effectiveness of implementation of IOSA program in Sudan Airways Company; ground handling section.
And its impact on safety and performance of company and quality of service and products. The research explains the barriers and difficulties those are facing company when implementing the IOSA program.
The study reflects the lack of implementation of IOSA program in Sudanese airlines which it is implementing just in Sudan airways; hence encourages other airlines to adopt the IOSA program throughexplained its benefits.
the objectives of research are: identify the Impact of Implementation of IOSA audit programme in the airlines organisational performance, improve the quality of products & services in airlines organizations and ensure the continued safety and regularity of international air transport.
The effectiveness measured through the test of hypotheses which involves fifteen statements.

The first hypothesis there is an impact of implementation of IOSA audit programme on airlines organizational Performance.

The second hypothesis there is no relationship between IOSA audit programme and quality of products and services improvement in airline.

The third hypothesis there is an impact of implementation of IOSA audit programme on the safety of international air transport

The questionnaire distributed on technicians and other employees aware by program to present their opinions in the impact of implementation of program on the safety, performance and quality of service and process in Sudan airways.

After that collected and analyzed by using the SPSS program.

To explain the direction of response median was determined . According to statistical analysis requirements changed all the nominal variables to quantitative variables, and prove the hypotheses by using the chi square test to accept or reject the null hypothesis H_0 and alternative hypothesis H_1.

The result of analysis proved the trueness of all hypotheses at significant level (5%) and 95% degree of confidence.

The research conclusion explains the significant role of IOSA program on safety .the future recommendations explain what the Sudan civil aviation, Sudan government and Sudan airways shall do to ensure the effectiveness of implementation of program and encourage other airlines to adopt it.

المستخلص:

يدرس هذا البحث تأثير تطبيق برنامج الايوسا على سلامة الطيران في الخطوط الجوية.

تناول البحث شركة الخطوط الجوية السودانية :قطاع قسم المناولة الأرضيةو نشاطاته تتمثل في: خدمة المسافرين ،شحن العفش في الطائرة ،وزن واتزان الطائرة و خدمات المعدات الارضية.

يدرس البحث مدى فعالية تطبيق برنامج الايوسا في قطاع المناولة الارضية وتاثيره على السلامة والاداء وجودة الخدمات والمنتجات بالشركة،كما يوضح المشاكل والعوائق التي تواجه الشركة في تطبيق البرنامج.

كذلك يعكس البحث قلة تطبيق برنامج الايوسا في الخطوط الجوية في السودان حيث يطبق فقط في شركة الخطوط الجوية السودانية، فعليه يشجع بقية الخطوط على تبني برنامج السلامة الايوسا عن طريق توضيح فوائده وميزاته.

اهداف البحث تتمثل في: توضيح اثر تطبيق برنامج الايوسا علي الاداء المنظمي بشركات خطوط الطيران،تحسين جودة العمليات والمنتجات وضمان السلامة المستمرة للنقل الجوي العالمي.

فعالية تطبيق البرنامج قيست عن طريق اختبار فرضيات البحث والتي تحوي خمسة عشره حالة خمسة لكل فرضية، الفرضية الأولى أن تطبيق برنامج الأيوسا يؤثرعلى الاداء المنظمي لخطوط الطيران،الفرضية الثانية ليس هناك علاقة بين تطبيق البرنامج و تحسين جودة الخدمات والمنتجاتوالفرضية الثالثة وهي:أن تطبيق برنامجالأيوسا يؤثر علي السلامة العالمية للنقل الجوي. تم توزيع الاستبيان على الفنين والمهندسينوغيرهم من موظفي الشركة لمعرفة اراءهم حول تأثير تطبيق البرنامج على السلامة،الاداء وجودة الخدمات والمنتجات بسودانير. ثم جمعت وحللت بإستخدام برنامج الحزم الاحصائية للعلوم الاجتماعية ،ولتوضيح اتجاه الاستجابة تم حساب الوسيط ووفقا لمتطلبات التحليل الاحصائي تم تحويل جميع المتغيرات الاسمية الي متغيرات وصفية واثبتت الفرضيات عن طريق استخدام اختبار مربع كاي لقبول او رفض فرضية العدم H_0 او الفرضية البديلةH_1.

نتيجة التحليل اثبتت صدق الفرضيات عند مستوى دلالة(5%) و درجة مصداقية(95%).
خلاصة البحث اوضحت اهمية دور برنامجالأيوسا على السلامة ، التوصيات المستقبلية اوضحت
ماذا على الطيران المدني السوداني،حكومة السودان وشركة سودانير ان تفعله لضمان تطبيق
البرنامج بفعالية وتشجيع بقية الخطوط على تبنيه.

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LIST OF ABBREVIATIONS:

AAs Auditor Actions

ACS Aviation compliance solution

AI Active Implementation

ALOS Acceptable Level Of Safety

AOs Audit Organizations

AQS Aviation Quality Service

CA As Civil Aviation Authorities

CAB Cabin Operations

CAR Corrective Action Report

CAP Corrective Action Plan

CGO Cargo Operations

CR Conformance Report

DSP Operational Control and Flight Dispatch

E- IOS A Enhanced IOSA

EMCA Emergency Management Centre

ERP Emergency Response Plan

FLT Flight Operations

FDM Flight Data Monitoring

GRH Ground Handling Operations

IAHIOSA Audit Handbook

IAR IOSA Audit Report

IAP Implementation Action Plan

IATA International Air Transport Association

ICAO International Civil Aviation Organization

IRM IATA Reference Manual

IOSA IATA Operational Safety Audit

IPM IOSA Program Manual

IPV IOSA preliminary visit

ISARPs IOSA Standards and Recommended Practices

ISM IOSA Standards Manual

LICCA Local Incident Control Centre

MNT Aircraft Engineering and Maintenance

MOC Memorandum of Cooperation

ORG Organization and Management System

PDC A "Plan, Do, Check, Act"

QMPs quality management principles

RCA root cause analysis

SA Safety Assurance

SEC Security Management

SMS Safety Management Systems

SPSS Statistical Package For Social Science program

SRM Safety Risk Management

SSP State Safety Plan

USOAP Universal Safety Oversight Audit Program

Appendixes:

Appendix A: explains how Sudan airways interested from FDM analysis in deep landingtraining

Appendix B: Sudan airways aviation safety bulletin

Appendix C: Sudan airways safety report

Appendix D: Sudan airwaysFDAnotification form

Appendix E: FDManalysis for Engine Pressure Ratio (EPR)

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CHAPTER ONE

(Basic of Research & Previous Study)

1.1 Theme one: The basic of research:

1.1.1 Backround:

The international civil aviationorganization (ICAO) drawn up by a conference in Chicago in November and December 1944, it has been headquarter in Montreal.

In October 1947 ICAO became specialized agency of the United Nations; currently it has 180 contracting states.

ICAO is standing body in charge of implementing the principles of convention so as to ensure the safe and orderly development of global civil aviation;it is responsible for safety, registration, airworthiness, and standardization and aviation law.

In 1999 ICAO lunched the universal safety oversight audit program (USOAP) it is aim to promote global aviation safety, it does by auditing contracting states. [11]

An international trend of aviation markets is the creation of larger, more cost-efficient airline business structures where economies of scale can operate. An example is the growth in global airline alliances and code-share agreements in recent years. The question that arises is can cost efficiency come without expense of safety? What tools areefficient enough to verify safety standards of airline carriers on world-wide scale?

A global trade association for the world's Airlines IATA (International Air Transport Association) founded in 1945 in Havana, Cuba, the headquarter in Montreal.

The International Air Transport Association (IATA) adopted a standard known as the IATA Operational Safety Audit (IOSA) to reduce the embedded threats to safety in airlines. [1]

IATA Operational Safety Audit initiated in 2001 with the first audits being administered in 2003, IOSA is now a global benchmark for airline safety. IATA has effectively raised the bar on safety by creating a global program, built on ICAO standards and best industry practices that is now recognized and accepted around the world.

The IATA Operational Safety Audit (IOSA) program is an internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline. [2]

IATA has a proactive and sustained history of cooperation with ICAO on safety.

To differentiate between ICAO and IATA; ICAO it is intergovernmental organizations which deals with regulatory aspects of national civil aviation oversight but IATA is effectively powerful body for international air carriers.[11]

To differentiate between IOSA and USOAP; USOAP; it does by auditing contracting states. To determine the state capability for safety oversight by assessing the effective implementation of critical of safety oversight system and the status of state implementation of safety related ICAO standard and recommended practice (SARPs).

1.1.2 Problem Statement:

Air Transport is global and hence the behaviour of each contract State can affect the world safety of Air Transport, A State's responsibilities ensures the continued safety and regularity of international air transport through applying the IOSA safety program in its airlines. The research examines the effectiveness of implementation of IOSA program in SudanAirways Company; ground handling section and its impact on safety and performance and quality of service and products.

1.1.3Research Questions:

1-How encourage airlines in Sudan to adopt and apply the IOSA audit program?

2-Sudan airways it is only the one Sudanese company is implementing the IOSA program so; is there is an effective impact on the performance, safety and quality of services and products of company or not?And if it is notwhat are barriers and difficulties are facing it?

1.1.4Research objectives:

The research aims to achieve the following:

-To identify the Impact of Implementation of IOSA audit programme in the airlines organisationalperformance.

-To improve the quality of services & products in airlines organizations.

-To ensure the continued safety and regularity of international air transport.

1.1.5 Research Hypotheses:

1-There is an impact of implementation of IOSA audit programme on airlines organizational Performance.

2-There is no relationship between IOSA audit programme andquality of products and services improvement in airline.

3-There is animpact of implementation of IOSA audit programme on the safety of international air transport

1.1.6 The significant of research:

First: For companies:

-Develop and promote the safety culture in Sudanese airlines.

-Encourage the airlines to apply the IOSA program and get its benefits and to be complying with the international standards.

Second: For researcher:

-Urged researchers to conduct more studies on this field of study and reflect its advantages.

1.1.7 Research Methodology:

Studies the IOSA audit program generally, the safety management system (SMS) and the implementation of IOSA audit programme in Sudan airways and how it is accomplished.

Survey questionnaire will be used and the data will be analyzed using technique available in SPSS to examine the impact of IOSA program on performance, safety and quality of services and process.

1.1.8 Research Structure:

Chapter one: IOSA audit programme anditsgoals, chapter two: a literature review of IOSA, Chapter three: safety management system (SMS).Chapter four; includes fourthemes: themeone:the implementation of program in a whole company and theme two: the implementation of program in ground handling operation section.

Themethree: material and methodology of research.Theme four: concludes the findings and the oversight future recommendation

1.2 Theme two: the previous studies:

1.2.1 First Study:

Analyzing aviation safety: Problems, challenges and opportunities, Clinton V. Oster Jr., John S. Strong andC. Kurt Zorn, School of Public and Environmental Affairs, Indiana University, Mason School of Business, College of William and Mary,2012.

Research problem:

Examines aviation security as a growingdimension of aviation safety; and identifies emerging issues in airline safety and challenges for aviation safety research.

Research Objectives:

firstly: Improving aviation security include: how much tofocus on identifying the terrorists as opposed to identifying the tools they might use; determining how torespond to terrorist threats; and determining the public versus private roles in providing aviationsecurity.

Secondly: Development and understanding of new forms of data to improve safety in other segments of commercial aviation, and moving from a

reactive, incident-based approach toward a more proactive, predictive and systems-based approach.

Conclusion:

Commercial airline safety has improved dramatically since theindustry's birth over a century ago. Fatal accident rates have fallen to the level where (along many dimensions) aviation is now the safest mode of commercial transportation. The next generation of safety challenges now require development and understanding new forms of data, and moving from a reactive, incident-based approach toward a more proactive, predictive and systems-based approach.

1.2.2 Second Study:

Airline Safety, Arnold Barnett and Alexander Wang, Massachusetts Institute of Technology Cambridge, May 1998

Research Problem:

Investigation include four groups of scheduled US flights: domestic jetservices by long-established carriers, domestic jet flights by post deregulation "new entrant"airlines, commuter air services, and international operations by US carriers. Examine too both domestic and international jet operations by First-World airlines outside the US, and corresponding operations in the Developing World.

Research Questions:

How to measure passenger safety (and how not to do so)?whyvolatility of mortality-risk data given the rarity of air crashes? What is implication of the ValuJet Crash?What is the comparative safety of auto trips and commuter flights?

Research Objectives:

The aim is to measure the recent risk level rather than discuss how to reduce risk.

Conclusion:

 The main conclusions have beenreached are these:

1- When measuring passenger mortality risk, one should worry about statistical indicators that pay no attention to the survival rates on fatal crashes, or that tacitly assume that the risk of a flight is proportional to its length or duration.

2- One should beware of the use of data about nonfatal accidents and incidents to "flesh out" an airline's safety record, and of the assertion that such data offer a more stable proxy for its underlying death risk than its recent fatalities record.

3- Passenger death risk per US domestic jet flight was about 1 in 7 million over the decade 1987-96.

4-The "new entrant" jet carriers formed in the US after airline deregulation suffered only one fatal event over 1987-96, but it was the notorious ValuJet crash in 1996. Statistical evidence fails to establish that ValuJet was operating less safely in recent23 years than major US jet carriers, or that other new entrants--which had no fatalities over the decade--were doing so.

5-The death risk per flight on US commuter flights was about 1 in 2 million over 1987- 96. This excess over the corresponding rate for domestic jets was statistically significant. Although it is a truism that planes are far safer than cars, careful drivers who replace commuter flights with auto trips do not thereby heighten their mortality

risk.

6-In First-World countries other than the US, death risk per domestic jet flight fell from 1 in 2 million over 1977-86 to 1 in 11 million over 1987-96. The corresponding risk on international flights was stable at about 1 in 4 million (as opposed to a stable risk of 1 in 1.5 million on the international jet flights of US carriers).

7- It is no longer accurate to proclaim US jet carriers "the safest in the world," for, over 1987-96, their counterparts in the rest of the First World achieved lower death risk than they did on both domestic and international operations. However, this reversal is not statistically significant; indeed, if the focus is on 1988-97 rather than 1987-96, the two groups of domestic carriers have nearly identical death risk (1 in 10

Million per flight). It appears that First-World nations are quite homogenous in aviation safety, much as they are on most other dimensions of mortality risk.

8-Developing world airlines continue to be generally riskier than those in the First- World: compared to First-World levels, their mortality risk for 1987-96 was roughly a factor of 15 higher for domestic jet operations. However, the discrepancy was smaller for international flights and, for those international routings on which First-World andDeveloping World airlines compete.

1.2.3Third study:

Standardization and business development: the global impact of the IOSA standards and the value of anticipation, David Hodgkinson, the University of Western Australia, 2006.

Research problem: Examines the impetus for IOSA program and its standards development process. It then analyses the economic, business and social impact of the development and use of IOSA standards with a focus on the linkages between standardization and business development.

Research Objectives: Reduce the cost of airline industry; improve the safety through performance standards and Creation and collaboration involving teams to facilitate the standards development process.

Conclusion:IOSA standards assist industries seeking to address current issues of global economic.IOSA demonstrates that long term, anticipatory and innovative thinking, practiced by coalitions made up of disparate parties and moving quickly can have significant economic, business and social impact and developing solutions- in developing standards. Business can move ahead of and push governments.

1.2.4Forth Study:

A Synthesis of Safety Culture and Safety Climate Research,Douglas. A. Wiegmann, Hui Zhang, Terry L. von Thaden, Gunjan Sharma, and Alyssa A. Mitchell,Aviation Research Lab,Institute of AviationUniversity of Illinoisat Urbana-Champaign, , Jun 2002.

Problem:

Synthesizing the existing literature on safety culture in order to develop a better understanding of its nature, dimensions, and impact on operational safety.

Research Objectives:

Enable researchers and safety professionals to better understand and assess safety culture and that it will facilitate the sharing of information and strategies for improving safety culture across organizations and industries.

Conclusion:

Results of the review revealed that most documented efforts to define and assess safety culture have arisen outside the aviation industry. Furthermore, there exists considerable disagreement among safety

Professionals, both within and across industries, as to how safety culture should be defined and whether or not safety culture is inherently different from the concept of safety climate. A synthesis of these different perspectives was conducted and hybrid definitions were proposed

which conceptualize safety climate as a temporal indicator of a more enduring safety culture. Adiscussion of key indicators of an organization's safety culture and the various methods commonly used to assess these factors was provided. A summary of the issues that must be

Considered when implementing a safety-culture assessment program was also presented.

CHAPTER TWO

(The Concept of IOSA Program)

2.1 Background:

IOSA is a systematic, explicit & comprehensive approach for continuous improvement in the quality of products & processes in airlines organizations.

The IATA Operational Safety Audit (IOSA) programme was implemented to achieve two fundamental aims – first and foremost to improve airline operational safety, and also to enhance efficiency through the reduction of redundant audits.

The IATA Operational Safety Audit (IOSA) Program is an internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline. IOSA uses internationally recognized quality audit principles so that audits are conducted in a standardized and consistent manner figure

(2-1) illustrate IOSA concept. [2]

Figure 2-1: IOSA concept

Inherent in the IOSA Programmed is a degree of quality, integrity and security such that mutually interested airlines and regulators can all comfortably accept IOSA audit reports. As a result, the industry will be in a

position to achieve the benefits of cost-efficiency through a significant reduction in audit redundancy. [1]

2.2 Sources for IOSA Standards and Recommended Practices (ISARPs):[9]

The safety and security requirements published in the Annexes to the Convention on International Civil Aviation (ICAO Annexes) are the primary source for specifications contained the ISARPs. Safetyand security requirements in the ICAO Annexes used as the basis for ISARPs are those that are applicable either directly or indirectly to the air operator.

2.2.1 Explanation of ISARPs:

ISARPs have been developed solely for use under the IOSA program and Contain the operational criteria upon which the audits are based. ISARPs are not regulations.

1-Standards:

IOSA **Standards** are specified systems, policies, programs, processes, procedures, plans, sets of measures, facilities, components, types of equipment or any other aspect of operations under the scope of IOSA that have been determined to be an operational necessity, and with which an operator will be expected to be in conformity at the conclusion of an audit.

Standards always contain the word "shall" (e.g., "The Operator shall have a process…") in order to denote conformance is a requirement for IOSA registration.

During an audit, determination of nonconformity with specifications contained in an IOSA Standard results in a Finding, which in turn results in the generation of a Corrective Action Report (CAR).

To close a Finding, an operator will develop a Corrective Action Plan (CAP), and then implement corrective action in accordance with the CAP.

2- Recommended Practices:

IOSA **Recommended Practices** are specified systems, policies, programs, processes, procedures, plans, sets of measures, facilities, components, types of equipment or any other aspects of operations under the audit scope of IOSA that have been determined to be operationally desirable, but conformity is optional by an operator. Recommended Practices always contain the word "should" (e.g., "The Operator should have a policy…") to denote conformance is optional.

During an audit, a determination of nonconformity with specifications contained in an IOSA Recommended Practice results in an Observation, which in turn results in the generation of a corrective action record (CAR).

An operator is not obliged to close an observation with corrective action but, as a minimum, must provide the root cause analysis (RCA) portion of the CAP. However, if an operator chooses to close an Observation, it will require subsequent implementation of corrective action the same as is required to close a Finding.

3- Operational Audit:

During an audit, an operator is assessed against the ISARPs contained in the ISARPs manual. To determine conformity with any standard or recommended practice, an auditor will gather evidence to assess the degree to which specifications are documented and implemented by the operator. In making such an assessment, the following information is applicable:

A-Documented:

Documented shall mean the specifications in the ISARPs are published and accurately represented by an operator in a controlled document. A controlled document is subject to processes that provide for positive control of content, revision, publication, distribution, availability and retention.

Documentation is necessary for an operator to ensure systems, programs, policies, processes, procedures and plans are implemented in a standardized manner, and to further ensure such standardized implementation is sustained on an on-going basis.

Documentation provides the standards that govern the way personnel perform tasks within the management system and in operations. Such documented standards are necessary for an operator to:

- Provide continuity in the flow of information to personnel;

- Ensure personnel are properly trained;

- Conduct evaluations (e.g. audits, inspections, performance assessments).

B-Implemented:

Implemented shall mean the specification(s) in the ISARPs are established, activated, integrated, incorporated, deployed, installed, maintained and/or made available, as part of the operational System, and is (are) monitored and evaluated, as necessary, for continued effectiveness.

The continuity of implementation is directly linked to documentation. To ensure standardization within the management system and in the conduct of operations, an operator must ensure specified systems, programs; policies, processes; procedures and plans are implemented as published in its controlled documents.

The requirement for specifications to be documented and implemented by an operator is inherent in ISARPs unless indicated otherwise.

C-Active Implementation

Certain IOSA Standards may be designated as eligible for the application of Active Implementation, which is a concept that permits an operator to be in conformity with a standard based on a demonstration of active and real progress toward completion of an acceptable Implementation Action Plan (IAP).

An acceptable IAP defines and maps out the satisfaction of all requirements for an operator to achieve conformity with the designated IOSA Standard. As a minimum, an acceptable IAP shall

Specify:

- A detailed schedule of all work or activities necessary to complete the IAP.

-All equipment, components, material or other physical resources necessary to complete the IAP.

- A date when the plan is projected to be completed.

To conform to a standard based on Active Implementation, an operator must be able to provide evidence that execution of an acceptable IAP is underway and material or physical progress toward completion of the plan is consistent with the planned schedule, as measured against published milestones. If applicable, an operator must also demonstrate satisfaction of any associated prerequisite conditions.

An operator that provides only an IAP without other demonstrable evidence of having materially or physically begun execution of the plan does not meet the criteria for conformity based on Active Implementation.

2.2.2 IOSA Documentation System:[6]

The ISM is used in association with the following related manuals:

1- IOSA Program Manual (IPM); Revisions to the ISM are developed and issued in accordance with the IOSA Standards Change management process, which is published in the IOSA Program Manual (IPM).

2-IATA Reference Manual for Audit Programs (IRM); The IATA Reference Manual for Audit Programs (IRM) contains the Glossary of Terms and the List of abbreviations that are associated with the IOSA program.

3- IOSA Audit Handbook (IAH); The Interlinked ISARPs lists are used for cross-checking and harmonizing assessments with common Operational elements across all applicable disciplines, e.g., Dangerous Goods provisions contained in FLT, GRH, CGO and SEC elements.

The IPM, ISM, IRM and IAH comprise the IOSA documentation system

2.3AuditScope:

2.3.1Purpose

The IOSA Standards Manual (ISM) is published in order to provide the IOSA standards, recommended practices (ISARPs), associated guidance material and other supporting information necessary for an operator to successfully prepare for an audit.

The ISM may also be used as a guide for any operator desiring to structure its operational management and control systems in conformity with the latest industry operational practices.

The ISM is the sole source of assessment criteria to be utilized by auditors when conducting an audit against the ISARPs. [9]

2.3.2 Structure: [9]

The ISM is organized as follows:

Section 1 → Organization and Management System (ORG).

Section 2 → Flight Operations (FLT).

Section 3 → Operational Control and Flight Dispatch (DSP).

Section 4 → Aircraft Engineering and Maintenance (MNT).

Section 5 → Cabin Operations (CAB).

Section 6 → Ground Handling Operations (GRH).

Section 7 → Cargo Operations (CGO).

Section 8 → Security Management (SEC).

2.3.2.1 Section 1—Organization and Management System (ORG) which contains :

1- Management and Control:

-Organization and Accountability

-Management Commitment

-Accountabilities, Authorities and Responsibilities

-Communication

-Management Review

-Provision of Resources

-Operational Planning

2- Documentation and Records

-Documentation System

-Records System

3- Safety Management

-Safety Risk Management

-Safety Assurance

-Flight Safety Analysis Program

-Quality Assurance Program

-Outsourcing Quality Control

-Product Quality Control

4 -Emergency Response

Emergency Response Plan

2.3.2.2 Section 2—Flight Operations (FLT) which contains:

1- Management and Control

-Management System

-State Requirements

-Authorities and Responsibilities

-Communication and Coordination

-Provision of Resources

-Documentation System

-Operations Manual

-Records System

-Quality Assurance Program

-Outsourcing and Product Quality Control

-Safety Management

2- Training and Qualification

-Training and Evaluation Program

-Training Elements

-Line Qualification

-SMS Training

3- Line Operations

-Common Language

-Flight Crew Qualifications

-Flight Crew Responsibilities

-Flight Crew Scheduling

-Flight Preparation

-Route and Airport Planning

-Fuel, Weight/Mass and Balance, Flight Plans

-Aircraft Preflight and Airworthiness

-Ground Handling

-In-Flight Operations

-Flight Deck Policy and Procedures

-Flight Deck, Passenger Cabin, Supernumerary Compartment Coordination.

-Non-Normal/Abnormal and Emergency Operations

-Flight Crew Reporting Requirements

4- Operations Engineering Specifications

-Aircraft Performance

-Navigation and Facilities

-Aircraft Systems and Equipment Specifications

-Cargo Compartment Systems and Equipment Requirements

-Flight Deck Security Equipment Requirements

2.3.2.3 Section 3—Operational Control and Flight Dispatch (DSP) which contains:

1- Management and Control

-Management System

-Authorities and Responsibilities

-Communication and Coordination

-Provision of Resources

-Documentation System

-Operations Manual

-Records System

-Quality Assurance Program

-Outsourcing and Product Quality Control

-Safety Management

2-Training and Qualification

-Training and Evaluation Program

-Training Elements

-Line Qualification

3- Line Operations

-Flight Preparation and Planning

-Aircraft Performance and Load Planning

-Icing Conditions

-Flight Monitoring and In-Flight Management

4-Emergency Responses

Operational Control Requirements and Specifications:

-Alternate and Isolated Airports

-Minimum Flight Altitudes and En Route Performance

-Fuel Planning

-Oxygen

-Operations beyond 60 Minutes from En Route Alternate Airport

-Performance-based compliance

2.3.2.4 Section 4—Aircraft Engineering and Maintenance (MNT) which contains:

1- Management and Control

-Management System

-Authorities and Responsibilities

-Maintenance Program

-Provision of Resources

-Communication

-Documentation System

-Maintenance Management Manual

-Maintenance Records System

-Quality Assurance Program

-Outsourcing and Product Quality Control

-Safety Management

2- Maintenance Control

-Control System

-Maintenance Planning

-Parts Installation

-Deferred Maintenance

-Continuing Airworthiness Information

-Repairs and Modifications

-Defect Recording and Control

-Extended Diversion Time Operations (EDTO)

-Aircraft Recorders

-Electronic Navigation Data Management

-Reduced Vertical Separation Minima (RVSM)

-Reporting to the Authority

3-Technical Records

-Aircraft Maintenance Records

-Aircraft Technical Log (ATL)

-Airworthiness Directives

4-Maintenance Organizations it should have:

-Approval

-Management

-Quality Assurance

-Personnel

-Training Program

-Facilities and Physical Resources

-Material Handling

-Procedures Manual

-Maintenance Release

-Tooling and Calibration

2.3.2.5 Section 5— Cabin Operations (CAB) which contains:

1-Management and Control

-Management System

-Authorities and Responsibilities

-Communication

-Provision of Resources

-Documentation System

-Operations Manual

-Records System

-Quality Assurance Program

-Outsourcing and Product Quality Control

-Safety Management

2-Training and Qualification

-Training Program

-Program Elements

-Line Qualification

-SMS Training

3-Line Operations

-Cabin Crew Requirements

-Cabin Crew Policies and Procedures

-Flight Deck Coordination

-Cabin Operations Policies and Procedures

4-Cabin Systems and Equipment

-Preflight Inspection

-Systems and Equipment Requirements

2.3.2.6Section 6—Ground Handling Operations (GRH) which contains:

1-Management and Control

-Management System

-Authorities and Responsibilities

-Communication

-Provision of Resources

-Documentation System

-Operational Manuals

-Records System

-Quality Assurance Program

-Outsourcing and Product Quality Control

-Safety Management

2-Training and Qualification

-Training Program

-Program Elements

-SMS Training

3-Ground Handling Operations

-Passenger and Baggage Handling

-Airside Operations

-Load Control

-Aircraft Loading

-Ground Support Equipment

-Airside Event Response and Reporting

-Security

4-Special Aircraft Ground Handling Operations

-Aircraft Fueling

-Aircraft De-/Anti-icing

2.3.2.7Section 7—Cargo Operations (CGO)which contains:

1-Management and Control

-Management System

-Authorities and Responsibilities

-Communication

-Provision of Resources

-Documentation System

-Operational Manuals

-Quality Assurance Program

-Records System

-Outsourcing and Product Quality Control

-Safety Management

2- Training and Qualification

-Training Program

-Program Elements

-SMS Training

3-Acceptance and Handling

-Dangerous Goods

-Live Animals and Perishables

-Unit Load Device (ULD)

-Combined Aircraft Operations

-Security

2.3.2.8 Section 8—Security Management (SEC) which contains:

1- Management and Control

-Management System

-Security Program

-Authorities and Responsibilities

-Communication

-Provision of Resources

-Documentation System

-Security Manual

-Records System

-Management Review

-Quality Assurance/Quality Control Programs

-Outsourcing and Product Quality Control

-Operational Reporting

2- Training and Qualification

-Training Program

-Security Operation

3-Passengers, Supernumeraries and Cabin Baggage

-Hold Baggage

-Cargo Shipments

4- Security Threat and Contingency Management

-Threat Management

-Contingency Planning

-Investigation and Notification

2.4 Primary IOSA Principle:[11]

A Two Stage Assessment:

2.4.1 First Stage - Assessment of Documentation:

1-ISARP specifications are published and accurately represented in a **controlled document** by the Operator.

2-A controlled document is issued and maintained by specific processes which control content, revision, publication, distribution, availability and retention.

3-Email messages, screen prints, photographs or other informal information sources which can be altered, are not controlled documents, unless specified as a controlled means of communication by the Operator.

2.4.2 Second Stage - Assessment of Implementation:

1-The documented ISARP specifications are in regular use by those responsible for implementation of specified systems, programs, policies, processes, procedures, functions, activities, etc.

2-Implementation of all documented functions is consistent and monitored and evaluated, as necessary, for continued effectiveness.

3-This ensures implementation is based on standard operating procedures and not on undocumented or handed down practices, for which standardization is not assured.

2.5 IOSA Audit definitions:

2.5.1 Objective:

1-The objective of audits conducted under the IOSA Program (by both Audit Organization AOs and Operators) is to determine an Operator's level of conformity with the ISARPs.

2-Conformity with a Standard or Recommended Practice requires that the applicable specifications contained therein are documented and implemented by the airline.

3- The function of the auditor is to gather sufficient evidence to indicate whether or not the specifications are, *documented* and *implemented* by the airline.

Note: Proper evidence collection is critical to ensuring an accurate conclusion of conformity or non-conformity with IOSA Standards or Recommended Practices.

2.5.2 Audit Methodology:

1-Assessing Conformance:

A-documented, implemented,

B-systemic applicability.

2-Conformance and Evidence:

   A. evidence collection,

   B. examining documents,

   C. interviewing personnel,

   D. auditor actions, auditing,

   E. ORG, auditing repeated ISARP,

   F. auditing outsourced functions, recording of nonconformities .

2.5.3 Audit Organizations (AOs):

1-Aviation Quality Service (AQS) –Germany.

 2-ARG/US pros-USA**.**

3-Aviation compliance solution (ACS) - Australia.

4-Wake (QA)UK.

5-SH&USA.

6-Morton Beyer and Agnew Inc- USA.

7-Quail-audit France

Note: Auditor organization it should change after each tow audits, All AOs offer global service.[3]

2.5.4 Airline's Role:

1-Train Internal Auditors to audit against ISARPs.

2-Internally assess all ISARPs at least once in registration period (24 months).

3-Obtain signed declaration of respective Senior Manager.

4-Produce and Submit Conformance Report to AO two weeks prior to IOSA Renewal Audits.

5-Make internal auditors available during IOSA Audit.

2.5.5 Audit Organization's (AO) Responsibilities:

AO reviews Conformance Report CR prior to Audit During the Audit, IOSA Auditors will assess the CR contents using selection of ISARPs IOSA Auditors will try to understand, how the operator assessed the ISARPs.

Audit Methodology for IOSA Audits by AOs will not change; Mandatory observations will be completed as usual AO makes final assessment of ISARPs under IOSA Audit If AO assesses ISARP as nonconformity, the conventional corrective action process follows (close findings not later than 1 month prior to expiry date).

2.6IOSA Registration Period:

1-An IOSA Operator will be required to conduct an audit of all applicable ISARPs during each IOSA registration period.

2- The IOSA registration period is defined as the 24 months during which an IOSA registration is valid.

3- The registration period is always established through an audit (initial registration audit or registration renewal audit) conducted by an Audit Organization (AO).

4- The IOSA registration period begins on the registration date when the registration is either first established or is renewed, and expires 24 months later on the expiry date (unless the airline opts to establish a new registration date).

2.7ISM Applicability for Internal Assessments:

2.7.1Description:

1-An Operator will conduct internal audits using the effective edition of the IOSA Standards Manual (ISM).

2- If a new edition of the ISM becomes effective during the first 19 months of the 24-month IOSA registration period, the Operator shall take into account all changes that might affect previous internal audit results. 3- If a new ISM edition is issued during the last five months of the 24-month registration period, the Operator may choose to submit a Conformance Report that reflects results from auditing against either the new edition or the previous edition. Figure (2-2) illustrated ISM Applicability for Internal Assessments. [11]
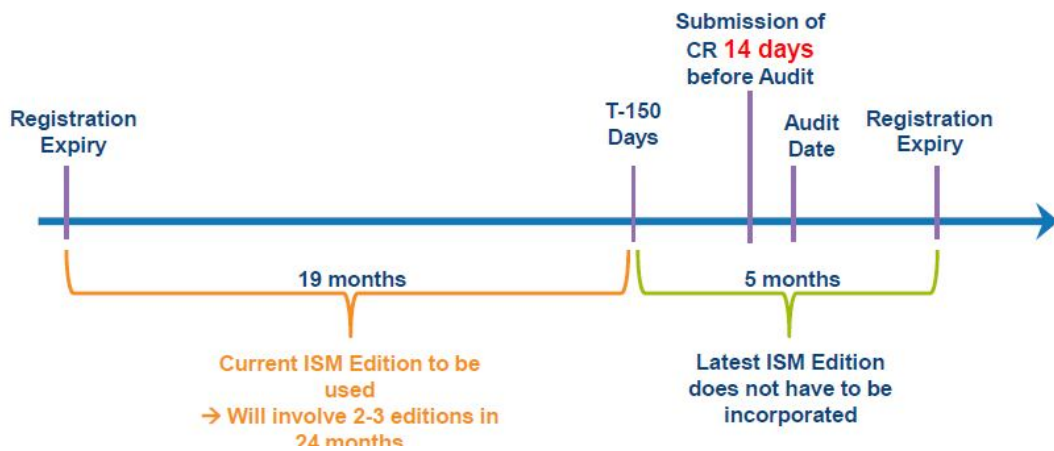
Figure 2-2:ISM Applicability for Internal Assessment

2.7.2Internal Audit Program Management:

Quality Assurance Program; ProgramRequirements:

1-An IOSA Operator will have a quality assurance program that provides for internal auditing of the management system, as well as operations and maintenance functions, such program includes:

A. A designated program manager.

B. A process for addressing program Findings that result from internal audits.

C. A process to ensure significant program issues is subject to management review.

D. A means for disseminating program information to management and non-management operational personnel.

E. A database to ensure an effective management of data derived from the internal audits of ISARPs under the quality assurance program.

2- In addition to requirements stated in (1) above, an IOSA Operator will ensure the quality assurance program includes internal auditing of the ISARPs and production of a Conformance Report during each IOSA registration period.

2.8 Auditor Actions (AAs)

AAs are effectively milestones in conventional IOSA audit path:

-The first AA represents confirmation that the auditor has identified the structure, system, policy, program, manual, process, procedure, etc., and associated controlled documentation.

-The second AA is confirmation that the responsible official has been identified and has described how the ISARP specification is implemented.

-The following key AA or group of AAs is confirmation of physical implementation of the ISARP specification.

AAs Benefitsare:

1-Record of the actions taken by auditors to assess implementation.

2-Standardize assessments of implementation across IOSA.

3-Provide transparency and traceability to the audit process.

2.9 Enhanced IOSA(E- IOSA):[5]

Since the introduction of IOSA in 2003, audit principles and protocols have basically remained unchanged. The initial goals of establishing a broad foundation for improved operational safety and security and eliminating redundant industry audits have been reached. The program is now being enhanced and broadened to include information from internal oversight assessments, enhancing the scope and value of the audit result.

2.9.1Objectives of Enhanced IOSA (E-IOSA):

Enhanced IOSA is only applicable for IOSA Registration Renewal Audits and will introduce significant new elements into the IOSA process. These elements have been applied and evaluated during proof-of-concept workshops and tested during live trial audits.

Airlines on the IOSA Registry will implement an internal training and qualification program for their internal auditors. Those will incorporate ongoing internal assessments using IOSA provisions in their Quality Assurance (QA) program. Before each renewal IOSA audit, the airlines will provide a Conformance Report (CR) to the Audit Organization (AO). The information in the Conformance Report will be reviewed and assessed against the respective IOSA provision.

The E-IOSA process takes advantage of a significantly broader information base, thus providing increased value and continuity to the audit resultFigure (2-3) explained E-IOSA process. [11]
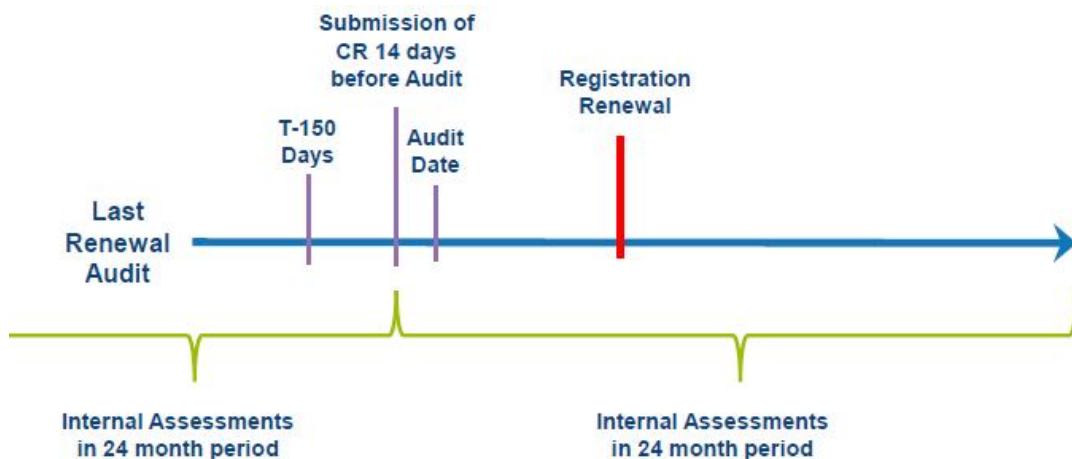
Figure 2-3: E-IOSAprocess

The overall objectives of Enhanced IOSA are based on supplementing and strengthening the four "pillars" of effective airline operations.

2.9.2E- IOSA Pillars:

Enhanced IOSA will facilitate the incorporation of four pillars in airline operations as illustrated in figure (2-4): [5]

| Continuous Conformity with IOSA Standards | Focus on Implementation of IOSA Standards | Reliability of Airline's Quality Assurance Functions | Auditing Standardization |

Figure 2-4: the E-IOSA pillar

A- Continuity: Operators will maintain continuing conformity with all IOSA standards throughout the registration period by conducting ongoing assessments as an integral part of their internal assurance programs. The results will be analyzed internally and any areas of concern will be addressed, thus leading to increased levels of continuity in all aspects of operations.

B-Implementation: Audit Organizations will focus on the implementation of specific IOSA standards through the observation of operational activities. The direct link between operational observations and IOSA standards will facilitate and enhance the overall assessment of operational policies, plans, processes and procedures;

C-Reliability: Operators will demonstrate the reliability and integrity of their internal quality assurance system by conducting ongoing internal assessments against ISARPs using trained and qualified auditors.

D-Standardization: Operators as well as Audit Organizations will use published Auditor Actions. The world-wide use of the Auditor Actions by all auditors will introduce a level of standardizations. [12]

2.10IOSA Q5AIMS(Audit IATA Management System) for Auditee:

The Q5AIMS electronic audit tool, as well as minimumrequirements for the documenting of corrective actions by the Auditee. Numerous examples of rootcauses, final actions required and final actions taken are also included. [10]

2.10.1Corrective Action Process:

The general corrective action process for closing Findings and/or Observations is set out below.

Each AO may have additional procedures that they will require the Auditee to follow**:**

1-A root cause and corrective action plan must be recorded for each Finding or Observation.The **Root Cause**, **Final Action Required** and **Date Due** fields of the Corrective Action Plans (CAP) in Q5AIMS must be completed and accepted by the AO within 45 calendar days of the Closing Meeting.

2-After the CAPs have been accepted by the AO, the Corrective Action for each Finding(and Observation (when applicable) must be implemented by the Auditee, in accordancewith the CAP within the required timelines.

3-During the corrective action process, the status of corrective actions should be regularlyreported to the AO.

4-The AO must be notified as soon as the corrective actions for each Finding and/orObservation (when applicable) are completed. Evidence of corrective actionimplementation must be provided to the AO.

5-The AO will review the evidence and either:

    A. Notify the Auditee that the corrective actions have been accepted, and theFinding or Observations are closed.

B. Advicethat further action is required.

2.10.2Accessing the System:

To gain access to the Q5AIMS server, any computer with an internet connection can be used. No additional software or components are required, as the system is accessed through a web browser (Internet Explorer, Firefox, Google Chrome).

All post audit activities are tracked and recorded using the Q5AIMS server. The information entered is immediately available to anyone involved in the follow up process that has the username and password.

2.11 Audit Reports:

The IOSA Audit Report (IAR) reflects the acceptable closure of all findings and is the official record of an audit.
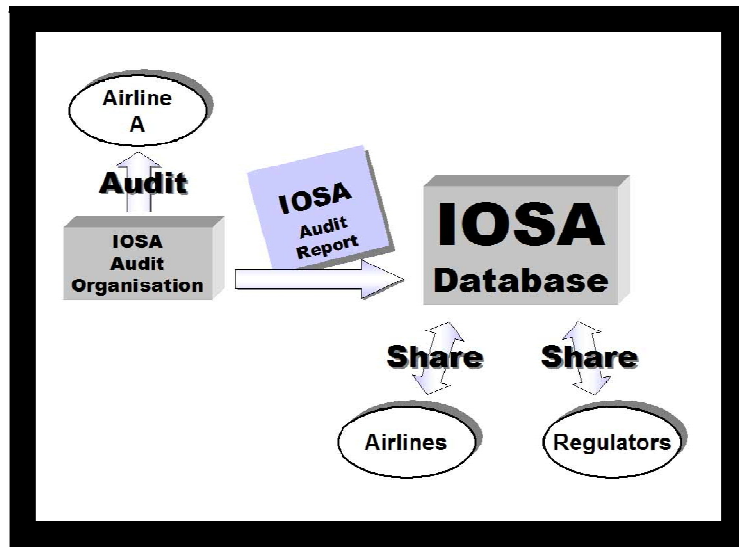
Figure 2-5: IOSA Audit reports and database

One important benefit of IOSA is achieved through audit sharing. IATA is the official custodian of all IOSA Audit Reports, facilitating secure and confidential access to this information by interested and approved parties. Once completing the initial audit, recurrent IOSA audits are required every two years.

Audits are accomplished by independent audit organizations and quality control of the audit process is maintained by IATA as figure

(2-5). [1]

CHAPTER THREE

(SMS Program as IOSA Requirement)

3.1 Introduction:

3.1.1 Safety Management Systems (SMS):

The components and elements of an SMS for air operators are published in the ICAO Framework for Safety Management Systems (SMS) as published in ICAO in Annex 19. Guidance supporting the Framework may be found in the ICAO Safety Management Manual (SMM), Doc 9859. All SMS components and elements contained in the ICAO Framework are addressed in the ISARPs.

Specific SMS requirements for an operator will always be mandated by the State in accordance with its individual State Safety Plan (SSP).

In aviation, the international governing body (ICAO) has followed this trend by adopting a requirement for carriers to develop safety management systems (SMS). [7]

3.1.2 SMS for IOSA-Registered Operators:

When the IOSA standards were first being developed in 2001, IATA recognized that SMS would eventually be required by ICAO for all air operators. With this in mind, fundamental concepts were incorporated into the first edition of the IOSA Standards Manual (ISM) published in 2002. Many of these best practices were considered so important to safety management that they were identified as "requirements" in Section one, Organization and Management System (ORG) of the IOSA Standards Manual (ISM) e.g. accountability, management review,

policy, planning, communication, resources, quality management and processes and emergency response, The Operator should have a safety management system (SMS) that is implemented and integrated throughout the organization to address the safety of aircraft operations.

3.2 Definition of Safety:

Safety is the state in which the risk of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuous process of hazard identification and risk management. This definition implies constant measurement and evaluation of an airline's safety performance and feedback into the SMS.

3.3 What is SMS?

ICAO defines an SMS as a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures. Airlines are responsible for establishing an SMS while States are responsible for the acceptance and oversight of an airline's SMS.

3.4 why SMS?

Effective safety management requires a realistic balance between safety, productivity, and costs. The process for achieving this balance is called system safety and is described by ICAO as balancing the needs of an organization in terms of production (delivery of services) and protection (safety).

SMS is designed to increase the knowledge and understanding of employee errors and operational issues in order to develop effective

mitigation strategies. Data sources, such as employee safety reports, allow the airline to analyze operational work errors and how they may

Contribute to a serious incident or accident. Both safety managers and line managers must understand that the following:

-Everyone make mistakes

-Errors are consequences rather than causes

-We analyze errors to help understand "why," not "what" or "who".

-Errors are precursors to a more serious incident or accident.

-Thorough investigation and analysis of errors will enable development of effective mitigations.

3.5Components of SMS:

The structure of   SMS may vary according to the size and complexity of a service provider and its aims and objectives. International Civil Aviation Organization (ICAO) and various Civil Aviation Authorities(CAAs) have produced guidance for service providers on the implementation of the four components and associated twelve elements that comprise an SMS framework.

 IATA aligns with the ICAO SMS framework The following four components and twelve associated elements, as a minimum, should be included in an SMS framework as illustrated in figure (3-1).

3.5.1 Safety Policy and Objective:

1-Management commitment and responsibility: Commitment of the senior management to safety is reflected in a policy statement, which is signed by the Accountable Executive.

2-Safety accountabilities: A statement of accountabilities clearly defines safety responsibilities of managers and employees at different levels in the organization, with effective deputation of responsibilities established for operationally critical areas when principal office holders are absent.

3-Appointment of key safety personnel: The Safety Manager, in most organizations, will be the person to whom the Accountable Executive has assigned the daily oversight functions of the SMS.

4-Coordination of emergency response planning: Service providers implement an Emergency Response Program (ERP) that includes contingency plans to ensure proper response throughout the organization when an emergency situation arises.

5- SMS documentation: Safety management activities must be documented appropriately and be available to all employees.

3.5.2 Safety Risk Management (SRM):

Risk is an estimation of the potential consequences of a defined hazard

1- Hazard identification: The airline must maintain processes that ensure that operational hazards are identified for all operational activities. Hazard identification is typically based on a combination of reactive, proactive, and predictive safety management methods.

2- Risk assessment and mitigation: Individual hazards are analyzed; their consequences are assessed and communicated throughout the organization. Mitigation actions must be developed for those hazards presenting unacceptable operational risk.

Risk Assessment:

-What is the hazard here?

-What are the risks here?

-What control measures we can put into place to reduce the hazard/risk?

RISK Mitigation:

-Eliminate Hazard.

-Reduce Risk.

-Influence decisions through public policy and cost / benefit analysis.

3.5.3 Safety Assurance (SA):

1-Safety performance monitoring and measurement: Safety Assurance **(**SA) activities focus on assessing the health of the organization, with an emphasis on safety. Specific goals for improvements in all areas should be set for all senior operational managers. SA should include monitoring of external sources of safety information and include participation in regional safety groups or safety data sharing organizations.

2-Management of change: External or internal changes may introduce new hazards to operational activities. Processes must exist to manage organizational responses to regulatory changes, major changes in operational procedures, or new activities such as new airport destinations. Safety reporting systems should have processes established to identify new risks and actively monitor performance in new areas of the operation.

3-Continuous improvement of the SMS: Safety Assurance **(**SA) utilizes quality tools such as internal evaluations or independent audits to assess organizational health from a safety perspective. Onsite assessments of operational management systems on a recurring basis provide opportunities for continuous improvement of processes and procedures for each functional area of the airline.

3.5.4 Safety Promotion:

1-Training and education:

The airline must identify safety training requirements for each level of management and for each employee group. Safety training for operational personnel should address safety responsibilities, including complying with

all operating and safety procedures, recognizing and reporting hazards, and ultimately ensuring that employees have the knowledge and skills to safely complete work activities.

2-Safety communication: Communication of safety information is a key responsibility for the Safety Manager. Continuous improvement and learning is accomplished through the sharing of lessons learned from investigations, hazard report analysis, and operational safety assessments.

Feedback to operational personnel, such as examples of procedural improvements as a result of safety reports, is an essential feature of safety communications.

Figure 3-1: SMS component

3.6Definition of Concepts:

As part of the SMS requirements, several concepts have been introduced:

-Level of safety: the degree of safety within a system expressed through safety indicators

-Safety indicators: the parameters that characterize and/or typify the level of safety of a system

-Safety targets: the concrete objectives of the level of safety

-Acceptable Level Of Safety (ALOS): the minimum degree of safety that must be assured by a system in actual practice

-Safety indicator value: the quantification of a safety indicator

-Safety target value: the quantification of a safety target

3.7Coordination of Emergency Response Planning:

Since commercial airline transport operations are based almost entirely on public confidence, any accident has a significant impact. A major accident resulting in   human suffering and loss of life will not only undermine public confidence in the industry as a whole, but particularly the company involved; It is therefore essential for an operator to have an Emergency Response Plan (ERP), also known as a Business Continuity Plan, as an integral part of its SMS.

Airlines:

It is the airline's responsibility to maintain familiarity with emergency plans at all airports into which it operates. Senior representatives of the airline

will be required to coordinate the airline's emergency response with the authorities at the accident location, and must therefore have a

readily available, tested, emergency response plan in place.

To fulfill its responsibilities, the airline must establish and equip:

-A Emergency Management Center (EMC) at its headquarters

-A Local Incident Control Center (LICC) at the accident location to coordinate activities with company headquarters and the local authority EMC.

-A mobile support and investigation team to assist local investigators and victim support service

3.8SMS Implementation:

The planning and implementation of a successful SMS takes time and effort. No one SMS is ideal for all organizations. It is necessary to adapt the SMS depending on the size and complexity of the organization in order to gain the greatest benefit.

1-Gap Analysis:

One of the first steps for an airline to take in order to implement an SMS is to asses which structures are already in place versus the SMS requirements. This process is called a gap analysis. ICAO has developed a generic SMS gap analysis checklist that will be of assistance in making an initial assessment.

2 -Safety Management Plan:

The next step in the SMS implementation is to ensure that an airline has a safety management plan. The principle elements of the safety management plan are the following:

-A definition of the fundamental approach a company will adopt for managing safety within the organization. This includes a safety policy statement that clearly defines the company's philosophical approach to safety and the performance goals it has set.

-Clearly defined roles and responsibilities for all personnel involved in safety, including chains of delegation to cover absences and changes of key personnel.

-A description of the SMS components (system assessment).

3- Safety Policy:

Following the system assessment, the airline needs to develop a safety policy, which is endorsed by the highest level of management.

An operator's safety policy should clearly state the company's intentions, management principles and aspirations for continuous improvement in the safety level of the company's operations and activities. The policy must be thoroughly documented, describing what organizational processes and structures it will use to achieve the SMS.

The safety policy must include a description of each SMS element in a similar manner to the descriptions of other systems in documents such as

the company Operations Manual, Maintenance Control Manual or Maintenance Policy Manual.

4-Provision of Resources:

Once the planning and policy stages have been established, the provision of resources must be considered to implement the policy and plan. The Accountable Executive must have the authority and control to provide financial and human resources to ensure that the SMS is effective.

Part of the resource allocation includes an employee selection process to ensure that positions within the organization are filled by personnel on the basis of appropriate knowledge, skills, training and experience.

The airline has a duty to ensure that the responsibilities and activities assigned to specific positions within the SMS are practical and can be reasonably accomplished, particularly for positions that require multiple functional responsibilities or maintenance of a specific technical

proficiency Therefore, personnel who perform functions that impact operational safety are required to maintain competence on the basis of continued education and training and, if applicable for a particular position, to continue to satisfy specific regulatory requirements. In addition, the airline must have a process for recording the satisfaction of training and qualification requirements for personnel who perform functions affecting operational safety.

5- Outsourcing of Services:

It is common practice for some operational functions to be outsourced to external contractors. It remains the responsibility of the airline to ensure that the service is performed to the safety standards.

Purchasing policies must therefore include controls to ensure the compliance with safety standards. Contractor selection procedures need to include a review of the contractor's safety management arrangements as well as any previous safety records. The contractor must be made aware of the airline's SMS and their responsibilities relative to it. The airline, or its designated approved representative, will need to carry out an audit of the services provided before commencement of work, and throughout the contract, to ensure that safety standards are observed continually.

6- Phased Approach to SMS Implementation:

In order to effectively manage the workload associated with the implementation of an SMS, it is recommended that airlines adopt a phased approach. This phased approach breaks down the SMS into manageable parts. During each of the phases, a certain number of elements are implemented at the airline, thus allowing for a building-block approach.

7-Continuous Improvement of the SMS:

Any commercial enterprise must embrace the concept of continuous improvement in order to remain viable in today's competitive world. SMS are never static and must not be considered completed once the basic components and elements are in place. The system must continually

evolve based on lessons learned, remediation of hazards, and identification of opportunities for improvement. Continuous improvement is a characteristic of a process and should be developed as an organizational culture that enables proactive risk management through process assessment and improvement.

Continuous improvement may be achieved through application of tools as the well-known "Plan, Do, Check, Act" (PDCA) pioneered by

 W. Edward Deming. A summary of the PDCA process is captured in table (3.1) below. [7]

Plan	↗ Determine responsibility
	↗ Determine requirements
	↗ Assess current processes
	↗ Gather baseline data
	↗ Set goals and determine performance measures
	↗ Formulate action plan
	↗ Train
Do	↗ Implement action plan
	↗ Make adjustments as needed
	↗ Gather and organize data
	↗ Train
Check	↗ Compare new data to baseline
	↗ Compare actual performance to goals
	↗ Make adjustments as needed
	↗ If significant gap(s) remain, re-examine root causes, formulate revised action plan and return to Do
	↗ Train
Act	↗ Standardize effective changes
	↗ Use data and improved outcomes to promote changes
	↗ Set up quality indicators and continue to measure periodically
	↗ Look for other places in the organization that might profit by your experience
	↗ Publicize your success
	↗ Be a Quality Advocate
	↗ Celebrate
	↗ Assess to identify other gaps

Table 3-1: illustrate the PDCA cycle

3.9IOSA SMS Strategy [4]**:**

-Full compliance 2016.

-The only remaining "should"- CAB performance indicators /targets.

-ORG SMS ISARPS are applicable throughout the "organization" – so to all Disciplines.

3.10Safety Risk Management by using Flight Data Monitoring (FDM) as IOSA recommended practice: [14]

A-The Operator should have a hazard identification program:

I) A combination of reactive and proactive methods for safety data collection;

ii) Processes for safety data analysis that identifies existing hazards and predicts future hazards to aircraft operations.

 The Operator shall have a Flight Data   analysis (FDA) program that is non-punitive and protects data sources.

B-Typical processes for hazard identification:

   i.   Confidential Reporting
  ii.   Investigation of Accidents / Incidents
 iii.   Flight data analysis
 iv.   Observation of crew performance
  v.   Quality Assurance / Safety Auditing
 vi.   Safety information exchange from external sources

3.11Flight Data Monitoring program:

 A program designed to enhance safety through the controlled, automated recording and analysis of flight data generated during routine line operations, a flight data monitoring (FDM) program involves the regular downloading, replay and analysis of data recorded during the airline's operation.

The results of the analysis can be used by many departments within an airline –for example: Operations, Safety, Training, and Engineering each with their own specific needs and wants. The FDM office manages all data and addresses all security and reporting issues Flight Data analysis is

a mirror of the airline operation so the program can be analyzed in order to reduce risk, so it is necessary to understand risk and assess whether such risk is reasonable and supportable; and When necessary, address risk.

3.11.1Objective:

To reflect the results of line operations by sectors or fleets.

Flight operations management has to use this information to set baseline and identify areas of improvement by identify training gaps, Advise what steps have been taken to correct adverse trends; and then The program monitors changes to measure effectiveness of corrections.

Compare Standard Operating Procedures (SOPs) with those performed in everyday line flight, FDM it is a feedback loop that should be part of a safety management system (SMS) will allow timely the corrective action to be taken where safety may be compromised by significant deviation from standard operating procedures as illustrated in figure (3-2).[14]
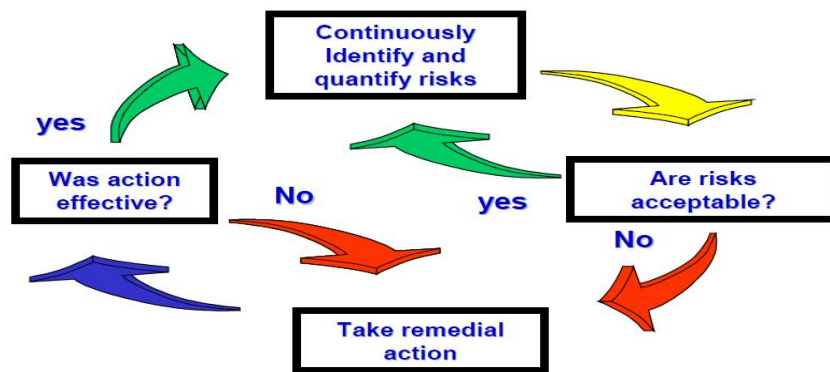
Figure 3-2: FDM as closed loop system

3.11.2 FDM Information Flow:

The figure (3-3) illustrated the information flow in the FDM system:[14]
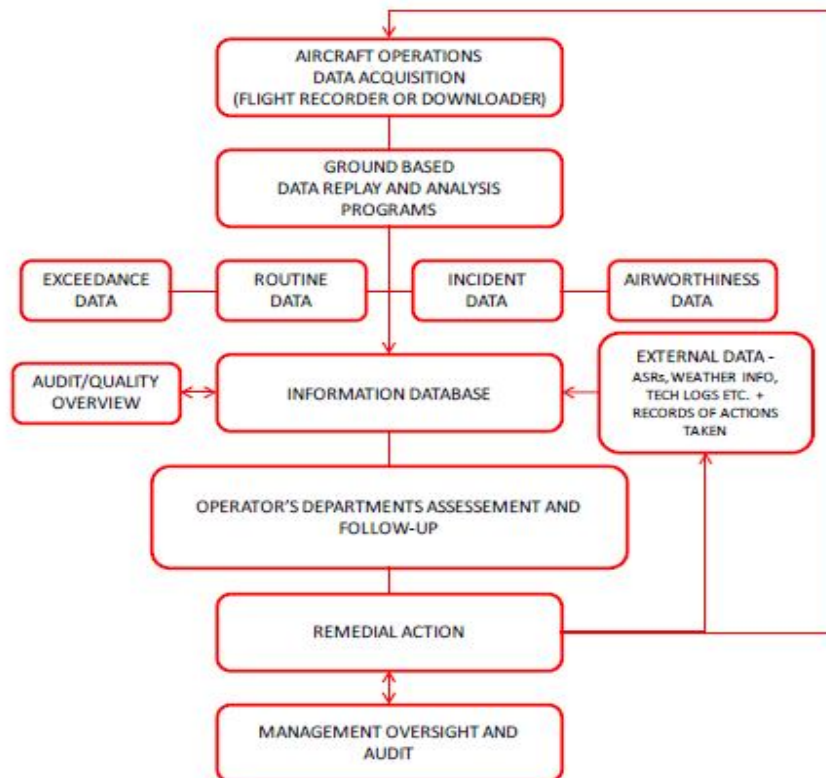
Figure3-3: FDM information flow

1-Data acquisition:

Data obtained from the aircraft digital system by a flight data acquisition unit (FDAU) and routed to the crash protected digital flight recorder (DFDR) this recorder has an easily removable recording medium (hence the name is Quick Access Record (QAR)) previously tape or optical disk, today more often memory cards or even on wireless system that require no physical removal of media.

The media is logged in replayed through a suite of computer programs starting with one that converts the raw binary data into engineering units. As illustrated in figure (3-4) bellow. [14]
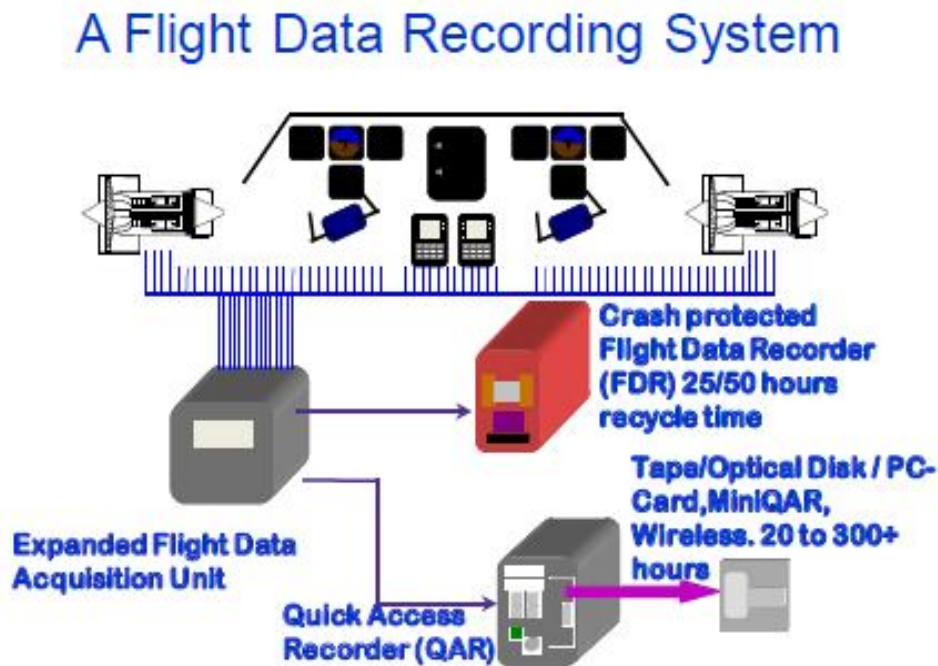
Figure 3-4: a flight data recording system

2-The FDM information forms:

A- Exceedance or event detection:

Is the standard FDM algorithmic methodology that searches the data for deviations from flight manual limits standard operating procedures and good airmanship?

Example: high take off rotation rate, flap limit speed Exceedance.

B-Routine data measurement:

Data obtained from all flights not just the significant ones producing event, the enables the monitoring of more subtle trends and tendencies.

Example measurement: takeoff weight, temperature, speed and heights.

C-Incident investigation data:

FDM data has been found to be very useful during the follow-up of mandatory occurrences and other technical reports, the data adds to the picture painted by the flight crew report, quantifying the impressions gathered from the recollections after the heat of the moment.

D-Continued airworthiness investigation data:

Both routine and event data can be utilize to assist the continued airworthiness function.

E-The information data base:

All the information gathered should be kept either in central data base or linked data base.

F-Operator's departments- assessment and follow-up:

This is the critical part of the process, given the system are put in place to detect, validate and distribute the information, the information finally reaches the areas where the operational safety and continued airworthiness benefit may be realized.

G-Remedial action:

Once hazard identified the first step has to be decided the level of risk is acceptable if not then the appropriate action to reduce the effect should be investigated along with the assessment of the wider effects of any proposed changes.

H-Continued Monitoring:

Once any action is taken, then an active monitor should be placed on the original problem and a careful assessment made of the other hazards in the area of change.

3.11.3 How SMS Can Benefit from FDM?

1- Gives knowledge of actual operation rather than assumed.

2- Gives depth of knowledge beyond accident and incident.

3- Helping define the buffering between normal and unacceptable operation and Indicates trends as well as the levels of risk.

4- Indicates potential as well as actual hazards.

5- Help identify area where flight crew training can be further improved.

6-Provides continuous and independent audit of safety standard.

7- Provides risk modeling information.

CHAPTER FOUR

(The Case Study, Material and Methodology, Conclusion and Recommendation and References)

4.1Theme One: Implementation of IOSA Program in a Whole Company:

4.1.1 Company history: [13]

Sudan Airways is the <u>national airline</u> of <u>Sudan</u>,headquarter in <u>Khartoum</u>. Sudan Airways started its flights in July 1947 with a fleet of 4 planes of DeHavillandtype; these were small size airplanes with 8 seats each.

When it was first established, Sudan Airways was part of Sudan Railways. It used to cover all destinations which were covered by Sudan Railways, such as, remote regional towns. The purpose was to link them with the Capital - Khartoum. In the first year, thus, its small fleet of airplanes successfully carried 736 passengers and 1543 KGS of cargo.

In 1952. Sudan Airways stared to addseven aircrafts type D.C. 3;capacityof 26 seats; itthen started its first international flights to Cairo in November 1954, Theflights were extended to Entebbe, Asmara, Aden Beirut and Jeddah in 1955.

In 1959, Sudan Airways became a member of the International Air Transport Association (IATA).

Thus, the Sudan Airways Company has started to progress in positive steps, by the efforts and efficient and high qualifications of its those who managed to break the circle of economic and financing embargo, by convincing the Western financing institutions, through the studied scientific plans, to support the fleet and modernize the Company. All these steps need the collaboration of everybody, so as to achieve better services.

4. I.2 IOSA Project:

Sudan Airways adopted the IOSA audit program project in the middle of 2006; which it is assigned the engineer Jamal Azmi to manage this project.

The company had completed contract with the Germany Company which called Aviation Quality Service (AQS); it isthe best but the toughest audit organization.

The Aviation Quality Service auditors visited the companyand did the gap analysis in December 2006. They shed light on the way of IOSA audit and explained for Sudan Airways IOSA teams the idea of audit, its techniques and requirements; during this period the candidate teams had taken a lot of IOSAcourses.

In 2007 ,Captain : Abd - ELgader Saeed was taking over the project management .The significant event in this period is IOSA preliminary visit(IPV) which resulted in about 354 findings; while in the final audit in November 2007, and within only six month , the findings werereducedfrom 354 to 157.

In May 2008 the IOSA teams under the supervision ofMirghani Mahmoud sent the corrective action plan (CAP), which supposed to be completed within one month from the audit final meeting (Feb 2008) .

The following table indicates to the final audit report in February 2008:

Discipline	Findings	Observations
Organization	15	10
Flight Operation	34	8
Dispatch	36	4
Engineering and MNT	14	0
Cabin Operation	2	1
Ground Handling	32	6
Cargo	16	3
Security	8	1
Total	**157**	**33**

Table 4-1: 2008 audit report

Sudan Airways was preparing for IOSA final audit by establishing the integrated safety system and quality system involved inall operations management.The company also established the electronic system to manage the documents and guidance material, and central library.

The company also participated in CARS closing course created by the IATA in 25December 2008 in Algeria which help the trainees to recognize and addressing the findings and contribute toaccomplish the audit without assistanceof external experts.

4.1.3Flight Data Monitoring program FDM program:

To support the safety, according to IATA requirement the company adopted Flight Data Monitoring program (FDM program) for two airbus300 and three Fokker 50.Sudan Airways FDR/CVR Specifications illustrated in tables (4-2), (4-3) and (4-4).

List of FDR and CVR installed in F50 fleet

	Model	Part No.	Serial No.
ST-ASO			
FDR	Honeywell	980-4100DXUN	9941
CVR	L-3	93A100-82	61986
ST-ASI			
FDR	Honeywell	980-4100DXUN	8717
CVR	L-3	93A100-80	56039

Table4-2: FDR and CVR installed in F50 fleet

List of FDR and CVR installed in A320 fleet:

	Model	Part No.	Serial No.
D6-CAS			
FDR	Honeywell	980-4700-042	12813
CVR	Honeywell	980-6022-001	120-08968

Table4-3: FDR and CVR installed in A320 fleet

List of FDR and CVR installed in A300-600 fleet:

	Model	Part No.	Serial No.
ST-ATA			
FDR	FA2100	2100-4043-02	000113788
CVR	Fairchild	93-A100-30	5012
ST-ATB			
FDR	FA2100	2100-4043-02	000118815
CVR VR	Fairchild	93-A100-80	25813

Table4-4: FDR and CVR installed inA300-600fleet

The FDMprogram facilitates the risk management process by analysis the flights information and hence it is easy to determine the deficiencies and how to eliminate from hazards, appendixesA, B, C, D, and Eexplain how the company interest from FDM technology through discovering the weakness in performance and how to correct and eliminate from it.

4.1.4Sudan Airways Training Center (SATC):

Was establishing 1968 it continued to conduct a series of courses covering simulator, ticketing, reservation, air cargo and technical training.

The instructor highly qualified trainers from Sudan and abroad especially from regional training center and the international air transport association (IATA).

Objective: evaluate the performance and add values to Sudan airways staff it is strive to present world class training in the fields of aviation.

4.1.5The Data Collection:

The table below explains the number of findings after each two year audit process starting from 2006 up to 2014; theinformation obtained from Sudan airways IOSA office, which this is the total findings for all company sections.

Finding	Year
350	2006
150	2008
50	2010
20	2012
10	2014

Table 4-5: explain the number of findings/two year

4.1.6Data Analysis:

We can explain the relationship between the numbers of findings per time by two ways:

A-By using the correlation; to explain the correlate between two variables (findings and year) by using Statistical Package forSocial Science program (SPSS).

B-Graphically by using the Microsoftexcel.

 A-Using the correlation coefficient:

Using the SPSS program and according to the below steps:

Open files in SPSS and define the variables as figure (4-1).
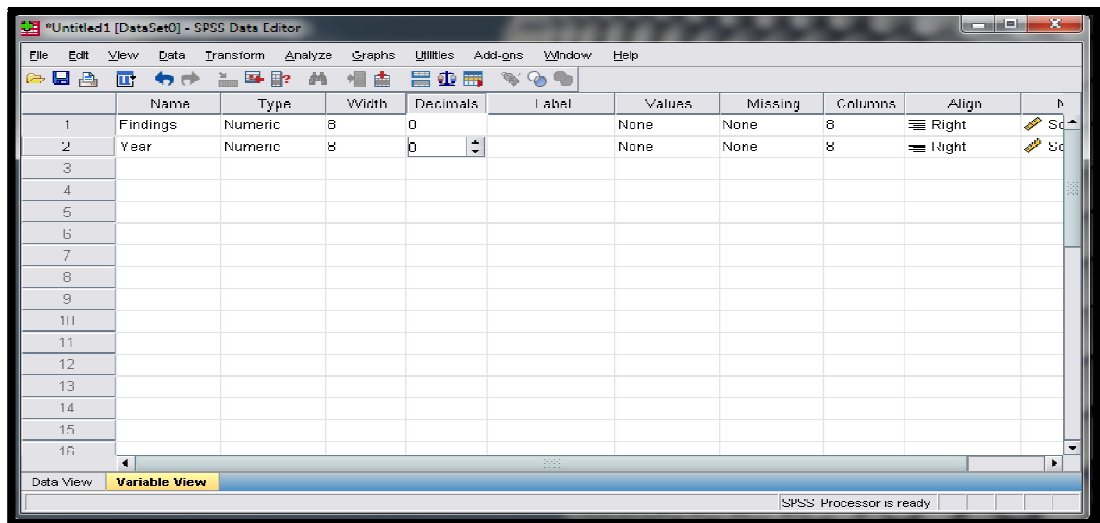
Figure 4-1: variables definition

Inter the variables in data view as figure (4-2).
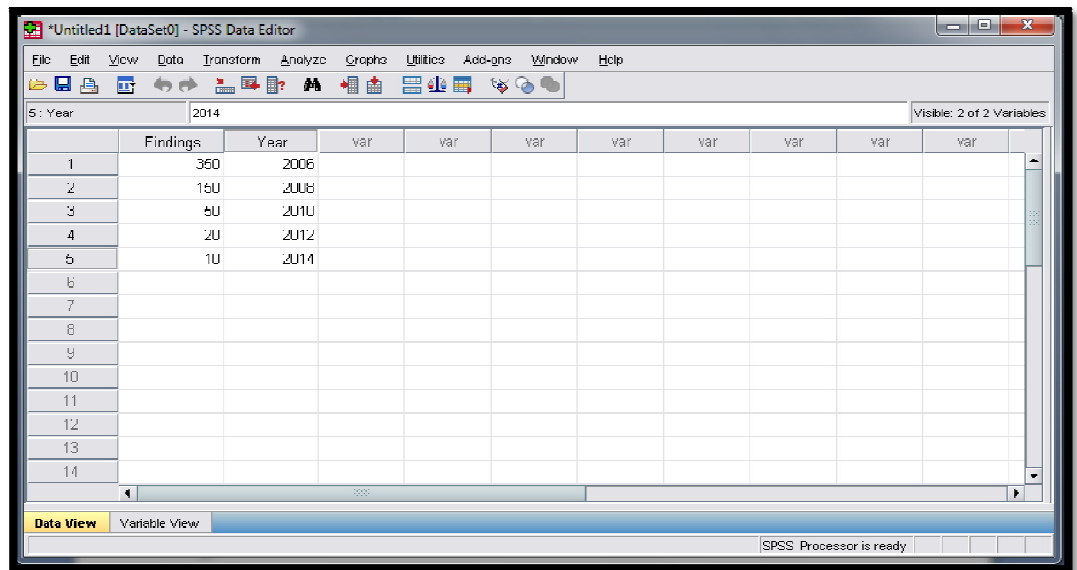
Figure 4-2: data entry

Go to analyze in tool bar –correlate-bivairiate asfigure (4-3).
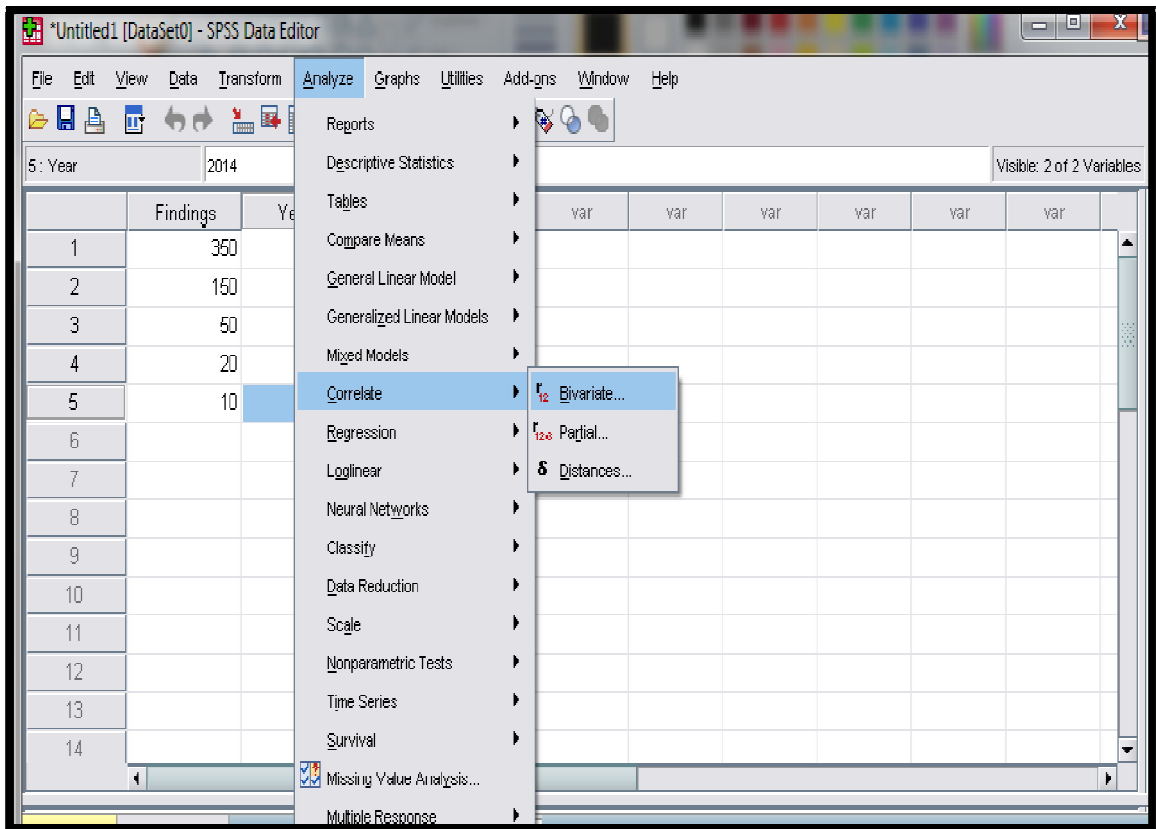
Figure 4-3: correlate selection

Move findings and year to variables then press ok as figure (4-4).
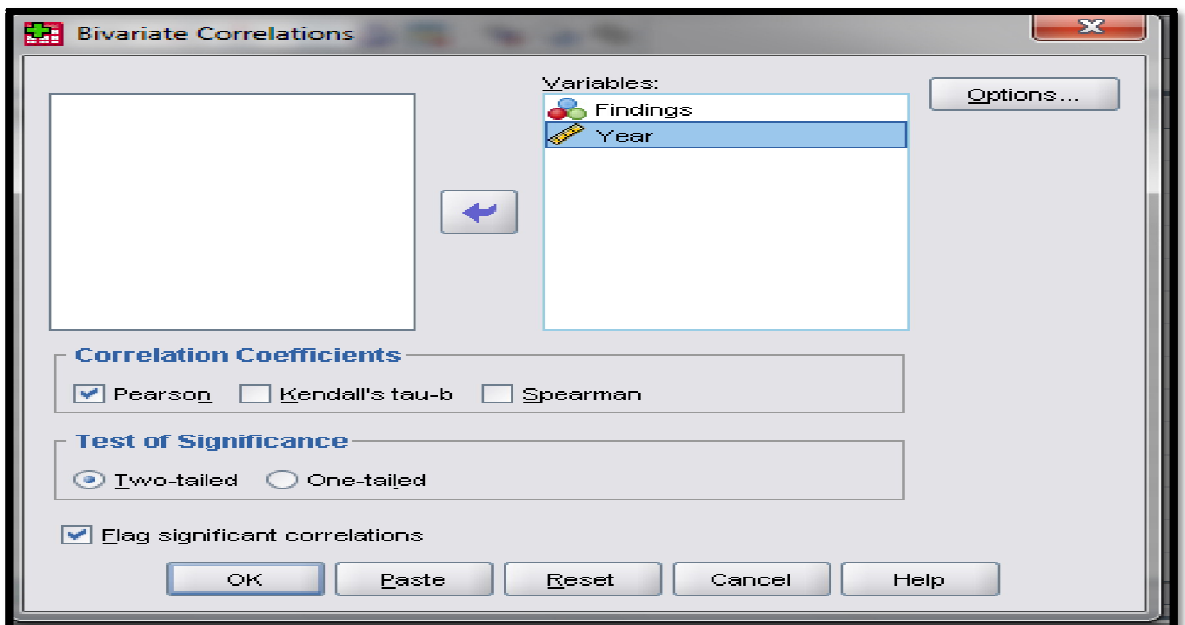
Figure4-4: bivariate correlations

We obtained the correlation table as illustrated in table (4-6).

Correlations

		findings	year
findings	Pearson Correlation	1	-.902[*]
	Sig. (2-tailed)		.037
	N	5	5
year	Pearson Correlation	-.902[*]	1
	Sig. (2-tailed)	.037	
	N	5	5

*. Correlation is significant at the 0.05 level (2-tailed).

Table4-6: correlation table

Analysis:

From the above table the:

Sig= **.037** it is less than .05 hence the correlation is significant.

Correlation coefficient =**- 0.902** it is strong negative correlation.

And the decreasing of findings is denoting to implement of ISARPs and this is desirable and hence positive result.

B-Graphically by using the Microsoft excel:

From figure (4-6) below we a observe the decrease of findings per time.
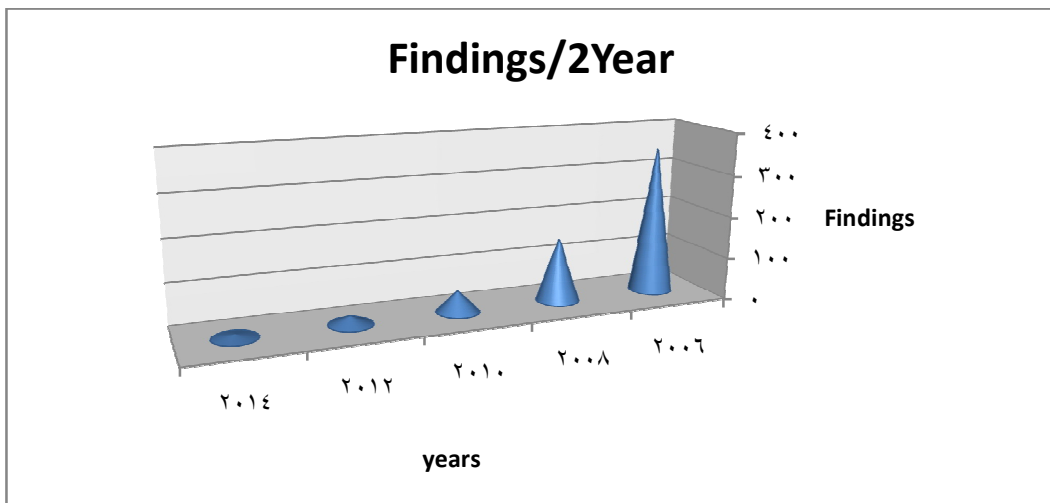
Figure 4-5: relationship between findings/2year

4.1.7 Results and discussions:

it's obvious from the above excel chart that the number of findings after each audit are decreasing, and from correlation table the strong negative correlation between findings and each audits it is desirable and hence positive result .

Discussed the information in the table (4-5) from the researcher perspective:

A-We see the gape analysis resulted the large number of findings (350) which it was the first IOSA audit this refers to:

-No management commitment.

-No financial commitment.

-No qualified staff (training).

-Sudan air staff needs more awareness.

-poor communication between all departments.

- Standard tasks didn't disseminate to the qualified staff.

- This is the first experience for the team to apply international standard.

B- We also see the number of findings decreasing after each audit that refers to:

- Year by year the increase of commitment has been done by top management.
- Sudan air jointed new equipment to promote the service performance.
- Training department provides more courses to increase staff knowledge.
- The communication between all departments has been improved.
- By practice audit continuously (every two year) the company got familiar with audit procedures.

4.2 Theme Two: Section6: Ground Handling Operation (GRH)In Sudan Airways:

4.2.1 Introduction:

In themeone described the implementation of IOSA audit program in the whole company, in this theme focuse on one section in company which it is ground handling operation in Sudan airways; how the IOSA requirements implementedand what are problems and deficiencies atthis section.

4.2.2 Ground handling operation:

Aircraft Handling:

Activities associated with servicing of an aircraft on the ground, including aircraft access, equipment attachment and removal, and operation of vehicles and equipment in the immediate vicinity of the aircraft.

4.2.3 Sudan airways ground handling management system:
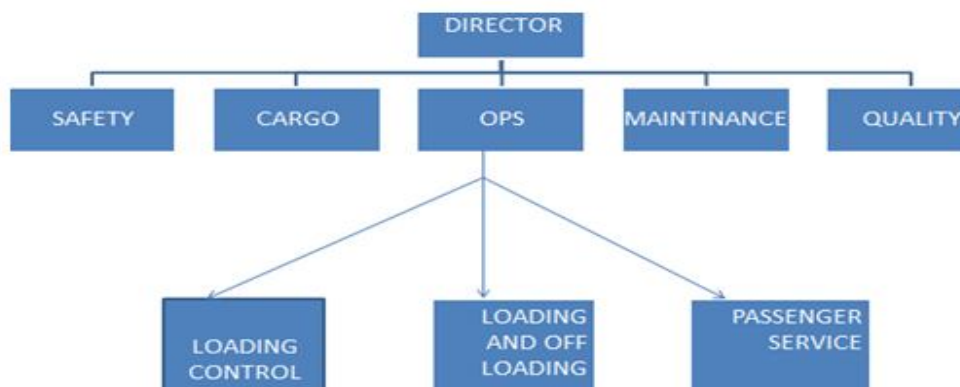
Figure 4-6: explain the GRH management system

Figure (4-6) explains the GRH management system as bellow:

Director: found to manage all the parts of GRH system.

Safety manager: to put the last requirement issued and ensure that all the service providedby safe manners. The task of him to do periodically reports to the quality department.

Cargo/Operations manager:cargo and ops managers responsible to provide the service to Sudan airwaysaircrafts and other carriers as per contract, operation and cargo managers shall be followed all the requirements that issued by international standard or as per agreement which signed with the client.

Maintenance manager:the major task of him is ensuring that the equipment maintained and will be safe during provide it or approached with the aircraft, should make sure the equipment move without any damage or leakage (oil, fuel hydraulic).

Quality manager: found to monitoring all the services that will provide by operation and cargo department and verify that the service has been follow the procedures and requirements.

The methods of verify the service processes are:

- Daily spot check.
- Quality control check.
- Annually internal audit.

The scope of ground handling operation and it is applicable to an operator (Sudan air ways)ground handling thatcontact:

Passenger, cargo andcombined (cargo and passenger).

4.2.4Functions within the scope of ground handling operation includes:

- Passenger handling.
- Baggage handling.
- Aircraft handling and loading.
- Load control.
- Ground equipment service.
- Aircraft bush back service.

1-Passenger handling:

Sudan airways committed to provide passenger service handling to the all clients that signed contract with Sudan airways as schedule flight or charter flight, the passenger service handling include the following:

-Check in counter service.

-Arrival terminal service.

2-Baggage handling:

Sudan airways committed to provide baggage handling for passenger purpose or for cargo purpose and it is committed to safe that baggage and protect from damage.

3-Aircraft handling and loading:

Include passenger baggage loading and off-loading.

4-Load control:

Sudan airways provides load control service that will do by qualified staff to distribute the baggage with the right way to maintain the center of gravity of aircraft to warranty that the aircraft fly under balance regulations.

5-Ground equipment service:

Sudan airways owns all the equipment that will be using to complete the ground handling service such as (passenger steps, baggage tugs, high loader build, baggage high loader, aircraft bush back tugs and aircraft towing two bar).

6-Aircraft bush back service:

Sudan airways provides s bush back service for Sudan airways aircrafts and other carrier, Sudan air has approval from Sudan civil aviation authority to submit this service due to there is no another company qualified to do this service.

4.2.5 The defects of Sudan airways:

A- a lot of clients left Sudan airways because the poor service due to:

-A lot of ground equipment need repair.

-More qualified staff left the company due to the poor salary.

-Sudan airways tools and facilities expired.

B- Not suitable work environment especially in the operations department which required renewing itsequipment and facilities.

C-Risk management system it is not effective operation due to the stopped of the FDM program technology   which Sudan airways can't update this software technology because it is high cost and hencethere is no risk analysis for its current flights.

4.2.6 Problems and difficulties facing company when implementingIOSA program:

-Lack of management commitment.

-Lack and high cost of resources (electrostatic unit devices, training, dangerous goods room…).

- The Sudan civil aviation disregard IOSA as benchmarking or standard while other country (Ex: Egypt) made it mandatory for all its airlines.

- IOSA standard, mainly SMS is ahead of ICAO SMS ,which result in slowness of implementation of SMS by Sudan civil aviation;which it is required only documentation stage (30%) while it is fully required by IATA(100%)and hence Sudan airways enforced to implement the SMS program without monitoring by Sudan civil aviation.

-Sometimes scheduling of the audit conflicts with AOs commitment; which sometimes is busy as time scheduled to do audit. This problem arises because it isn't allowedfor AO to execute more than two consecutive audits for the same airline in spite of small number of AOs (just eight).

-The embargo enforced on company made it to face trouble to obtained the spares parts and new aircrafts which reflects the fail of company to return it is the old image and international reputation.

4.3Theme Three Material and Methodology of research:

Firstly, the research starts with an introduction recognizes the history of international civil aviation (ICAO) and its safety oversight audit program, also recognizes the International Air Transport Association and its operational safety audit program (IOSA).Next explains the state of problem and the objectives of research were defined to give the clear idea of the research, also explains its hypothesis and structure.

Secondly, a detailed literature review of IOSA; that requires a general understanding of IOSA audit program.

Thirdly, studies the safety management system (SMS) and defines its component and how to apply it.

Fourthly, Studies the implementation of IOSA audit programme in Sudan airways and how accomplished explained that by analysis of statistical information obtained from Sudan Airways Company's IOSA office.

Further to that,the Survey questionnaire will be used and the data will be analyzed using technique available in SPSS to examine the impact of IOSA program on performance, safety and quality of service and process; questionnaires are being prepared after determining the type of approach and style that is suitable for the research survey.

The questions designed to check the level of understanding and implementation of IOSA in Sudan airways.

The first draft of questionnaire (after approved by direct supervisor) was sent to some of quality experts, all comments and suggestions were taken into consideration and corrections identified towards the improvement of questionnaire. After revising and gathering all useful feedback, the final questionnaire was distributed to the number of (50) employeeawarded IOSA program.

The survey carried out within fourweeks, while waiting for the survey's response, computer software of the statistical package for social science (SPSS) for the purpose of the research isfamiliarized in preparation for analysis, this section presents a detailed description of procedures followed by questionnaires to conduct the study field by definition of curriculum, describe the study population, to identify the study sample and tools of the study questionnaire, the standard of the study procedure and the statistical methods which was used in data processing to make sure of the credibility and stability and prove the hypothesizes   and results.

4.3.1 The study field procedures:

4.3.1.1 Study approach:

The researcher used descriptive analytical methods; which based on descriptive statistic, in order to describe the phenomenon under study, analyzes the data and identifies the relationship between component and operations contained and the resulting effects.

4.3.1.2 The study population:

The study population of company's employee awarded IOSA in all its sections (8 sections) at Khartoum international airport and company headquarter.

After determined the number of employee awarded IOSA (500) 10% has taken; (50)a random sample questionnaireshave been distributed, collected and analyzed.

4.3.2Descriptive analysis:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	50	1	2	1.32	.471
Age	50	1	4	2.28	.970
Experience	50	1	4	2.72	1.196
Position	50	1	4	3.00	.990
TEAMWORK	50	1	5	3.50	1.015
REDUCECOST	50	1	5	3.02	1.169
MANAGEMENTSYSTEM	50	1	5	3.18	1.224
IMPROVEENVIRONMENT	50	1	5	2.90	1.055
TRAINING	50	1	5	3.36	1.156
CUSTOMERSATISFACTION	50	1	5	2.72	1.144
SERVICESDEVELOPMENT	50	1	5	3.10	1.111
QUALITYAWARENESS	50	1	5	3.32	1.019
FREQUENTFLYING	50	1	5	2.32	1.096
PERIODICMAINTIANCE	50	1	5	3.26	1.242
REDUCEACCIDENS	50	1	5	3.66	1.154
SAFETYREPORT	50	2	5	3.42	.785
EMERGENCYRESPONSEPLAN	50	2	5	3.36	.921
INTERNATIONALSTANDARD	50	1	5	3.24	1.153
SAFETYPOLICES	50	1	5	3.36	1.225
Valid N (list wise)	50				

Table 4-7Descriptive statistic, source prepare by researcher (SPSS)

Personal Data4.3.2.1

4.3.2.1.1 Gender Frequencies:

Gender	Frequency	Percent
Male	34	68.0
Female	16	32.0
Total	50	100.0

Table 4-8: Gender

From the above table (4-8) we see that the frequencies of the gender "males and females" in the sample were "34and 16" sequenced which is 68.0% males and 32.0% females. The big different is due to the small number of females work in aviation fields or exclusive just in specific sections, and also due to the culture that prevent women from work.

The below graph fig (4-7) shows the description of the sample using the percentages.
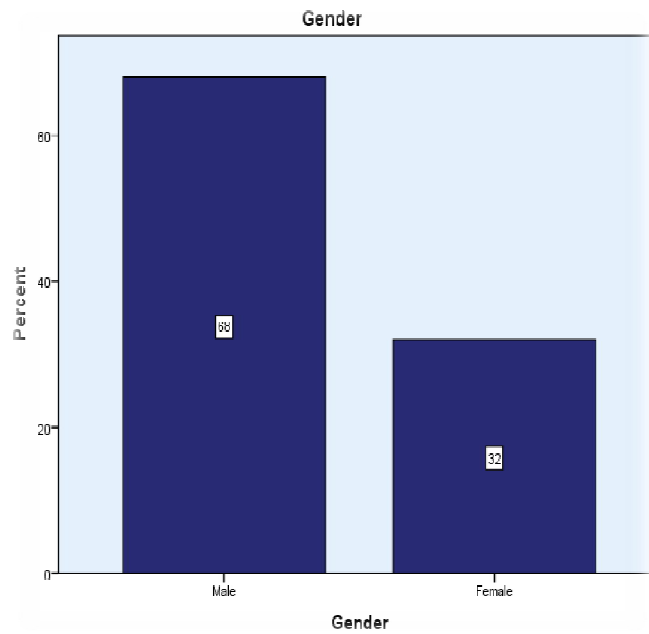
Figure 4-7: gender percentage, source prepared by the researcher (SPSS tool)

4.3.2.1.2Age Frequencies:

Age Decades	Frequency	Percent
20-30	10	20.0
31-40	24	48.0
41-50	8	16.0
51 and more	8	16.0
Total	50	100.0

Table4-9: Age

From the above table(4-9) we see the frequencies of the age groups in the sample "20-30, 31-40, 41-50, 51 and more" the frequencies of the age groups were "10, 24, 8, 8" Sequenced which is20.0%,48.0%,16.0%16.0% percentage.

Note that: the category of staff 31-40 most frequent and represented the highest portion of 48.0% which reflected the company rich by young staff and hence workforce .

The below graph fig (4-8) shows the description of age groups using the percentages.
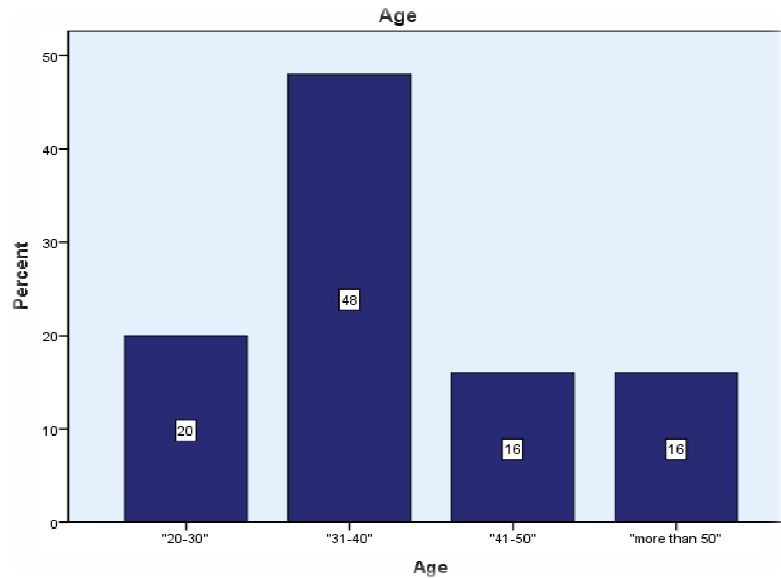
Figure 4-8: Age percentages, source prepared by the researcher (SPSS tool)

Experience Frequencies:4.3.2.1.3

Experience	Frequency	Percent
1-5	10	20.0
6-10	14	28.0
11-15	6	12.0
more than 15	20	40.0
Total	50	100.0

Table4-10: The Experience

From the above table(4-10) we see the frequencies of the experience years' groups in the sample "1-5, 6-10, 11-15, 15 and more" the frequencies of the experience groups were "10, 14, 6, 20" Sequenced which is 20%,28.1%,12%,40.0% percentages.

Note that: the category of experience more than 15 most frequent and represented the highest portion of 40.0% which reflected the company rich by experts and hence contribute in performance improvement.

The below graph fig (4-9) shows the description of experience years' groups using the percentages.
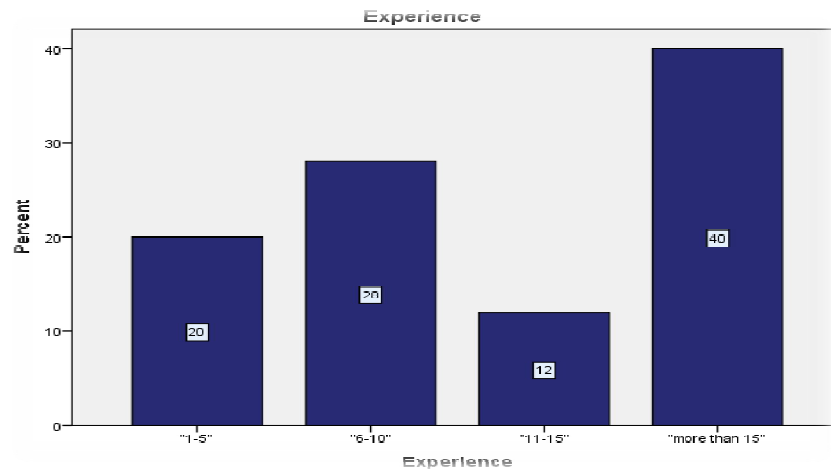
Fig 4-9: Experience percentages, source prepared by the researcher (SPSS tool)

Position Frequencies:4.3.2.1.4

Position	Frequency	Percent
Director	2	4.0
Head Section	18	36.0
Engineer	8	16.0
Employee	22	44.0
Total	50	100.0

Table4-11: Position

From the above table (4-11)we see the frequencies of the positions of people in the sample "Director, Head Section, Technician, Employee" the frequencies of the age groups were "2, 18, 8, 22" Sequenced which is 4.0%,36.0%,16.0%,44.0% percentage.

Note that: the employee position most frequent and represented the highest portion of 44.0% which reflected the company is rich by workforce.

The below graph fig (4-10) shows the description of the positions of people in the sample using the percentages.
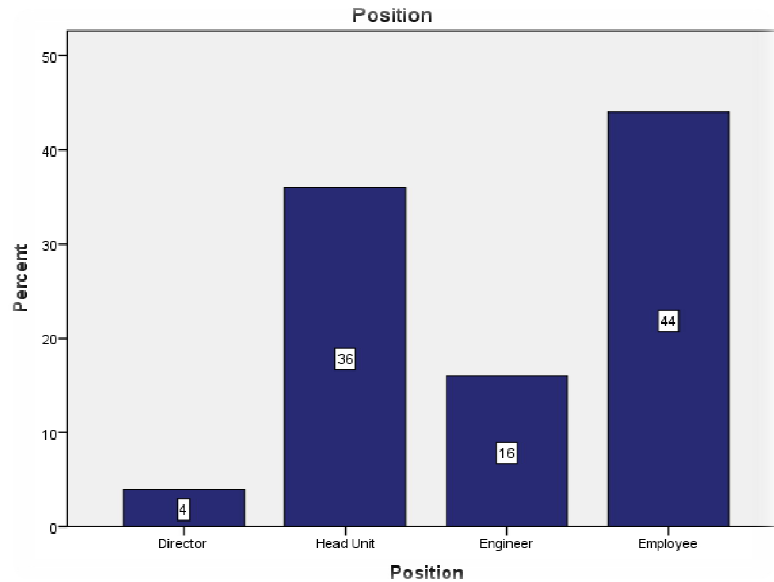
Fig 4-10: Position percentages, source prepared by the researcher (SPSS tool)

4.3.3 Questionnaire Answers:

To answering questionnaire's questions and proving its hypothesis, it will determine the median for each expression which explains the opinions of study population. (5) mark was given as a weight for each answer "strongly agree", (4) mark was given as a weight for each answer "agree", (3) mark was given as a weight for each answer "Neutral",(2) mark was given as a weight for each answer "disagree" and (1) mark was given as a weight for each answer "strongly disagree".

4.3.3.1 Impact of IOSA on performance question's answers:

No.	Question	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		COUNT	PER CENT	COUNT	PER CENT	COUNT	PER CENT	COUNT	PER CENT	COUNT	PER CENT
1	Team Work	1	2	10	20	8	16	25	50	6	12
2	Reduces Cost	5	10	13	26	13	26	14	28	5	10
3	Management System	4	8	12	24	14	28	11	22	9	18
4	Suitable Environment	2	4	21	42	10	20	14	28	3	6
5	Qualified Personal	4	8	7	14	14	28	17	34	8	16

Table 4-12: count and percentage answers of first hypothesis's questions, source prepare by researcher (SPSS)

Q1: The Implementation of IOSA program creates framework involving teams to facilitate the standard development process in Sudan airways?

Fig 4-11: Teamwork's answers percentage, source prepared by the researcher (SPSS tool)

The above figure (4-11) explains the teamwork's answers percentage, which (50%) agree that while (20%) disagree.

(50%) This reflects Sudan airways has communication system that enables an exchange of information relevant to the conduct of operations throughout the management system and in all areas where operations are conducted and encourages the teamwork.

Q2: The Implementation of IOSA program reduces the cost in Sudan airways?

Fig 4-12: cost decrease's answers percentage, source prepared by the researcher (SPSS tool)

The figure (4-12) explains the cost decrease's answers percentage which (28%) agree that while (26%) disagree.

(26%) it is high percentage so the company it should put effective strategies and plans to reduce the cost.

Q3: The Implementation of IOSA program creates management system ensures the control of process and safety management in Sudan airways?

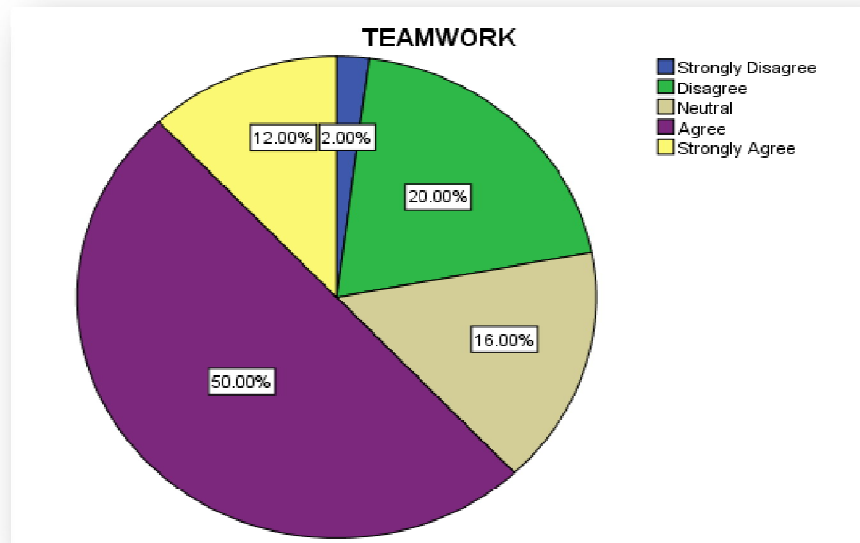Fig 4-13: Management System's answers   percentage, source prepared by the researcher (SPSS tool)

The above figure (4-13) explainsthe Management System's answers percentage which (28%) neutral, (22%) agree and (24%) disagree.

Sudan airways must put the effective plans lead to visible and tangible results.

The companyshall have an effective management system is fully implemented and functional with a clear consistency and unity of purpose between corporate management and management in the operational areas.

Q4: The Implementation of IOSA program creates suitable work environment   which the company provides all facilities and equipment that's requires to accomplish work properly?
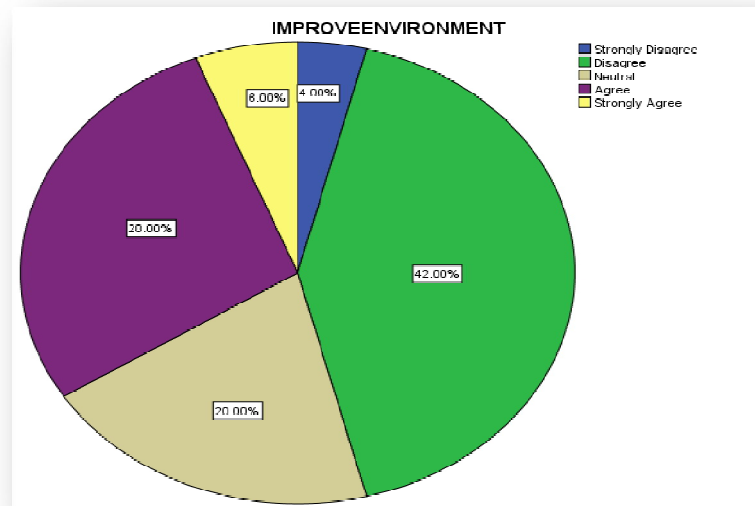
Fig 4-14: Improved Environment's answers percentage, source prepared by the researcher (SPSS tool)

The above figure (4-14) explains the Improved Environment's answers percentage which (28%) agree that while (42%) disagree.
(42%) disagree it is high percentage so Sudan airways   shall ensure existence of the facilities, workspace, equipment and supporting services, as well as work environment, necessary to satisfy operational safety and security requirement.

Q5: The Implementation of IOSA program in Sudan airways creates the qualified personnel through the continue training and education?
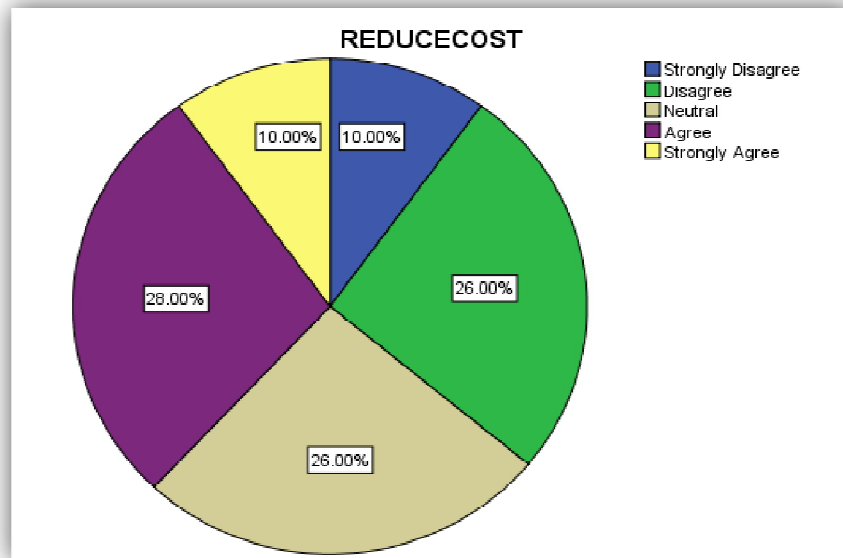

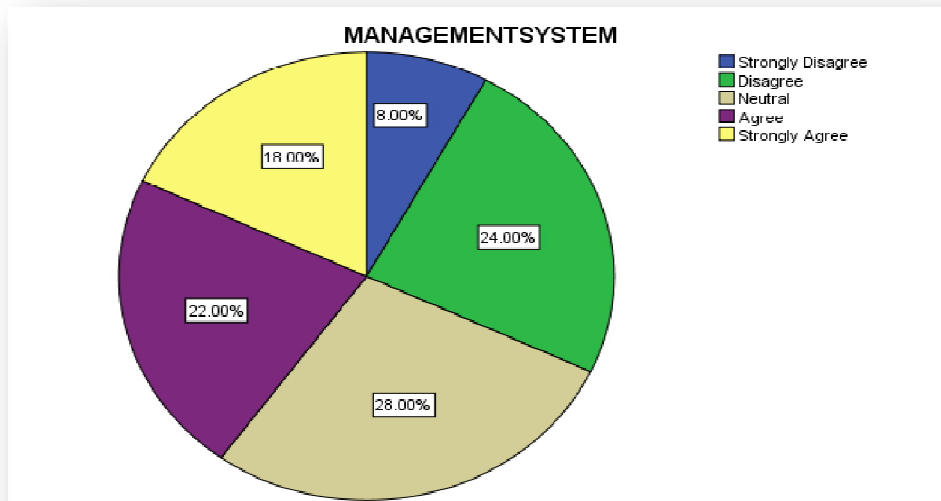Fig 4-15: Training's answers percentage, source prepared by the researcher (SPSS tool)

The above figure (4-15) explains the training's answers percentagewhich (34%) agree that while (14%) disagree. (34%) agree; this refer to Sudan airways has a training center to ensure course materials used in training programs for personnel responsible for operational control are periodically evaluated to ensure compliance with the performance standards .

4.3.3.2Impact of IOSA on the quality of service and products question's answers:

No.	Question	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		COUNT	PER CENT	COUNT	PER CENT	COUNT	PER CENT	COUNT	PER CENT	COUNT	PER CENT
1	Customer Satisfaction	9	18	12	24	15	30	12	24	2	4
2	service development	3	6	13	26	16	32	12	24	6	12
3	Quality awareness	1	2	10	20	18	36	14	28	7	14
4	Frequent Flying	13	26	17	34	13	26	5	10	2	4
5	Periodic maintenance	3	6	14	28	10	20	13	26	10	20

Table 4-13: count and percentage answers of
secondhypothesis's questions, source prepare by researcher(SPSS)

Q6: The Implementation of IOSA program in Sudan airways leads to customer satisfaction (internally and externally)**?**
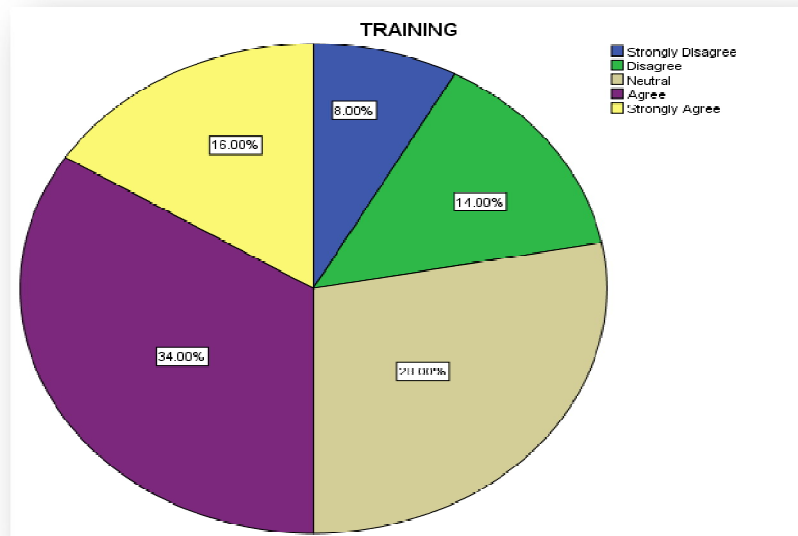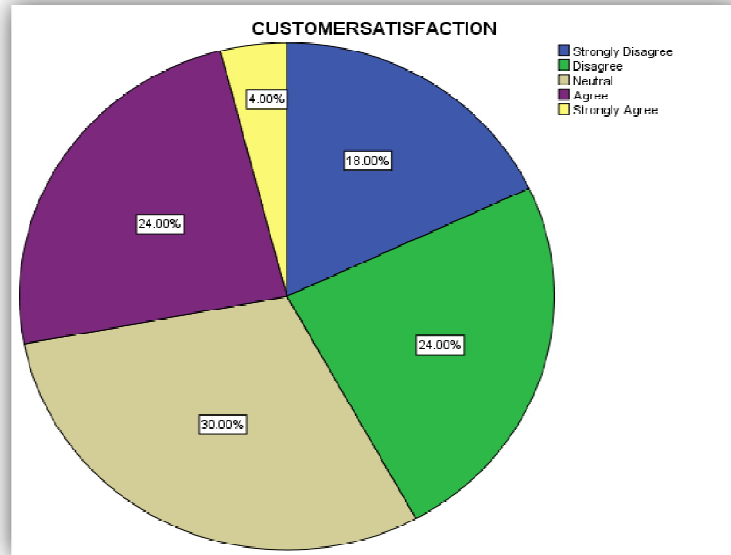

Fig 4-16: customer satisfaction's answers percentage, source prepared by the researcher(SPSS tool)

The above figure (4-16) explains the customer satisfaction's answers percentage which (30%) neutral, (24%) agree and (24%) disagree**.**

(30%) neutralso; Sudan airways must put the effective plans lead to visible and tangible results.

The equality percentage of agree and disagree so, the company shall use the effective strategies to ensure customer satisfaction by meeting their needs and expectation through enhance and improve itsservices.

Q7: The Implementation of IOSA program in Sudan airways develops the quality of services (catering, customer service….) and products**?**
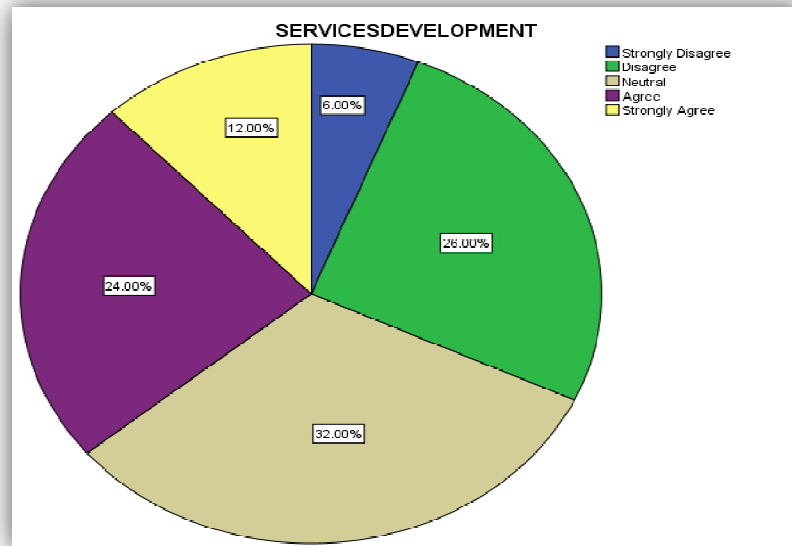
Figure 4-17: services development's answers percentage source prepared by the
researcher (SPSS tool)

The figure (4-17) explains the services development's answers percentage which (32%) neutral, (24%) agree and (26%) disagree**.**

(32%) neutral so; Sudan airways must put the effective plans lead to visible and tangible results and should develop and improve the level of service due to training its staff and provides suitable equipment.

Q8: The Implementation of IOSA program disseminates the quality concepts in Sudan airways?
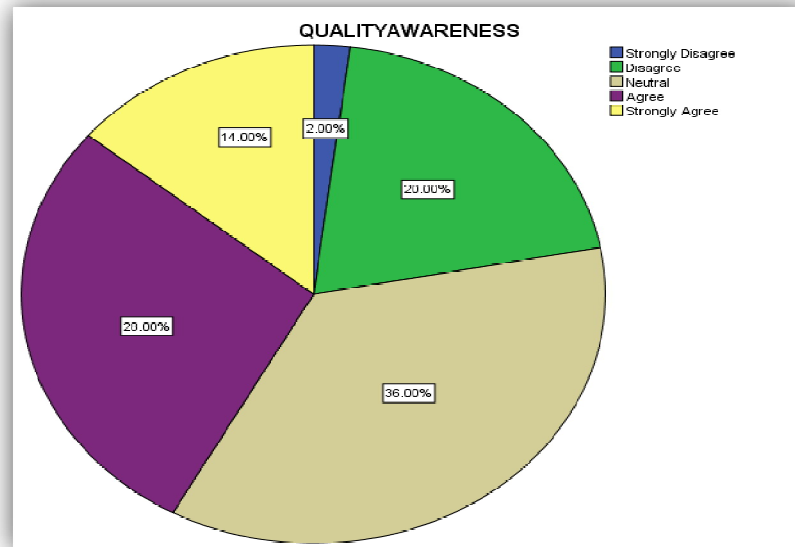
Fig 4-18: quality awareness's answers percentage, source prepared by the researcher (SPSS tool)

The figure (4-18) explains the quality awareness's answers percentagewhich (36%) neutral, soSudan airways must put the effective plans lead to visible and tangible results .

(26%) agree and (20%) disagree this due toSudan airwayshas a means for disseminating information from the quality assurance program to management and non-management operational personnel as appropriate to ensure an organizational awareness of compliance with applicable regulatory and other requirements.

Q9: The Implementation of IOSA program encourages the frequent flying which the flights meeting timescale (departure and arrival)?
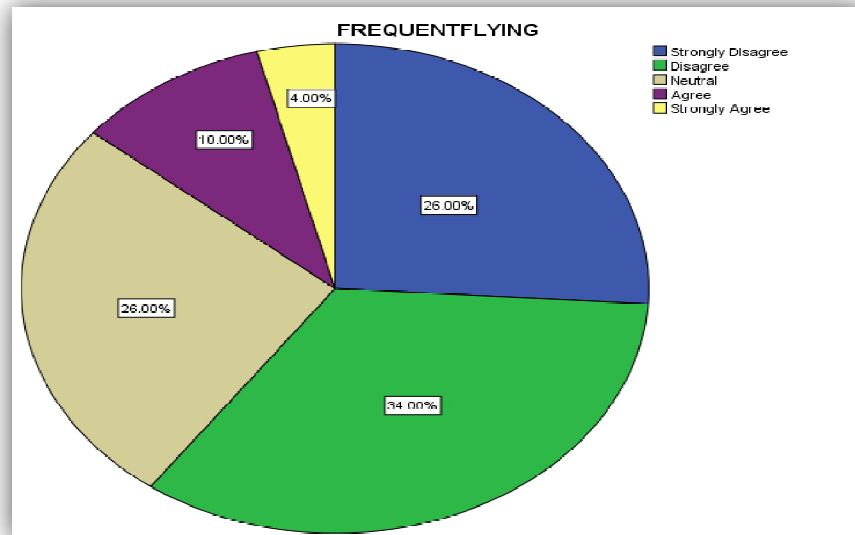
Fig 4-19: frequent flying's answers percentage, source prepared by the researcher (SPSS tool)

The figure (4-19) explains the frequent flying's answers percentage which (20%) agree and (34%) disagree**.**

(34%) disagree Sudan airways punctuality and hence the company should obligate by the schedule flights by purchasing aircrafts or lease it and hence it will ensure the loyalty of its customer.

Q10: The Implementation of IOSA program encourages company to possess valid equipment which it was checked and maintained periodically (tug, stairs...) ?
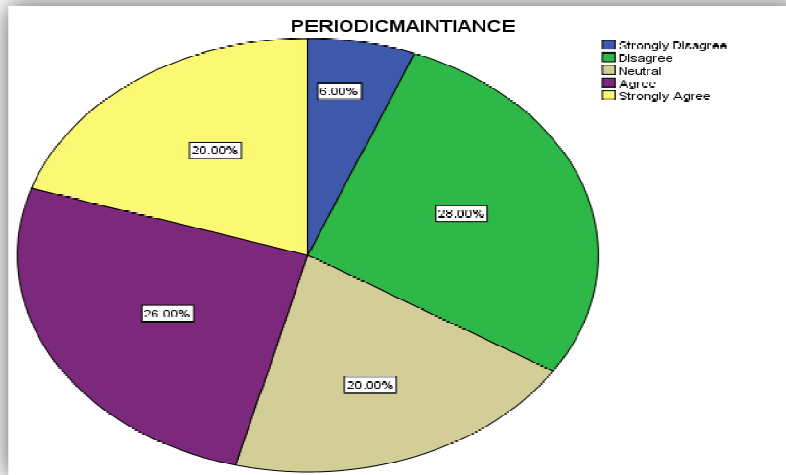
Figure 4-20: periodic maintenance's answers percentage, source prepared by the researcher(SPSS tool)

The figure (4-20) explains the periodic maintenance's answers percentage which (26%) agree and (28%) disagree.

Sudan airshould have processes to ensure equipment or other operational Products relevant to the safety or security of aircraft operations that are purchased or otherwise acquired from an external vendor or supplier meet the product technical requirements specified by the Operator prior to being used in the conduct of operations or aircraft maintenance and it should do periodic checks and maintenances for aircrafts and equipment.

4.3.3.3Impact of IOSA on safety question's answers:

No.	Question	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
		COUNT	PERCENT	COUNT	PERCENT	COUNT	PERCENT	COUNT	PERCENT	COUNT	PERCENT
1	Reduce Accident and incident	3	6	5	10	11	22	18	36	13	26
2	Safety Report	0	0	6	12	20	40	21	42	3	16
3	EPR	0	0	10	20	17	34	18	36	5	10
4	International Standards	5	10	6	12	18	36	14	28	7	14
5	Safety Policies	4	8	10	20	9	18	18	36	9	18

Table 4-14: count and percentage answers of third hypothesis's questions, source prepare by researcher (SPSS)

Q11: The Implementation of IOSA program in Sudan airways reduces the aircraft accidents?
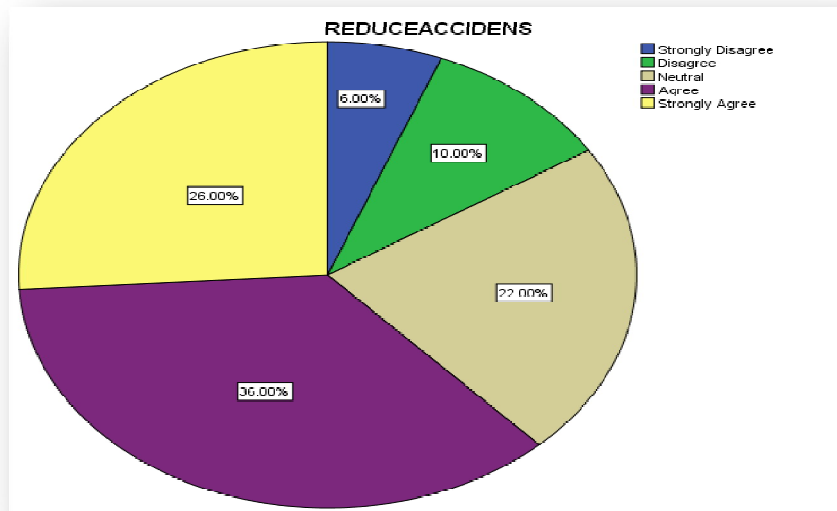
Figure 4-21: accidents decrease'sanswers percentage, source prepared by the researcher (SPSS tool)

The figure (4-21) explains the accidents decrease's answers percentage which (36%) agree and (10%) disagree.

(36%) agree Sudan air has a process for the investigation of aircraft accidents and Incidents, to include reporting of events in accordance with requirements of the State and the magnitude of accident decrease may be this due to obligate of company by regulations.

.

Q12: The Implementation of IOSA program in Sudan airways encourages employees to write the safety report for all abnormal events and hence contribute in risk analysis and mitigation?

Figure 4-22: safety report's answers percentage, source prepared by the researcher (SPSS tool)

The figure (4-22) explains the safety report's answers percentage

Which (42%) agree and (12%) disagree.(42%) agree;this is due to Sudan air has a non-punitive safety reporting system that is implemented throughout the organization in all areas where operations are conducted, a confidential safety reporting system that is implementedthroughout the organization in a manner that encourages and facilitates the reporting of events, hazards and/or concerns resulting from or associated with human performance in operations.

Q13: The Implementation of IOSA program in Sudan airways makes it has emergency response plan **(EPR)?**
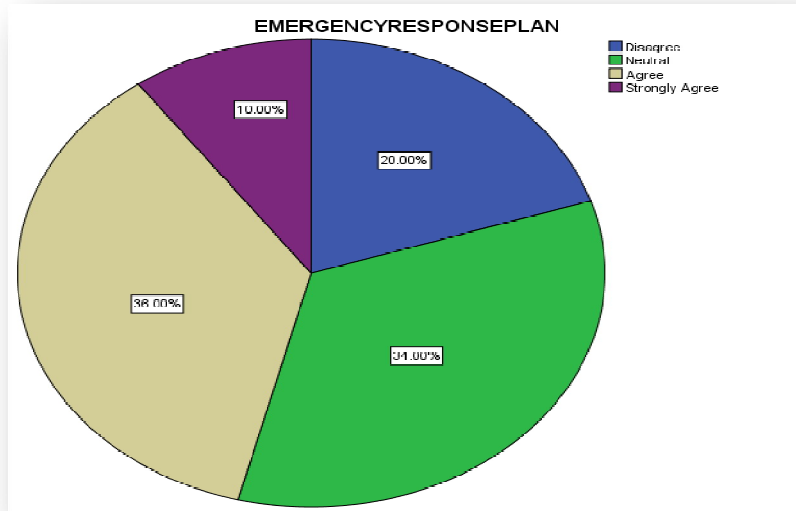
Figure 4-23: emergency response plan's answers percentage, source prepared by the researcher(SPSS tool)

The figure (4-23) explains the emergency response plan's answers percentage which (36%) agree and (20%) disagree.

(36%) agree; this due to Sudan air has a safety equipment and safety workshop, which safety equipment use in emergency cases like extinguisher and emergency exits in all company departments.

Q14: The Implementation of IOSA program makes company comply with international standards and requirements in safety?
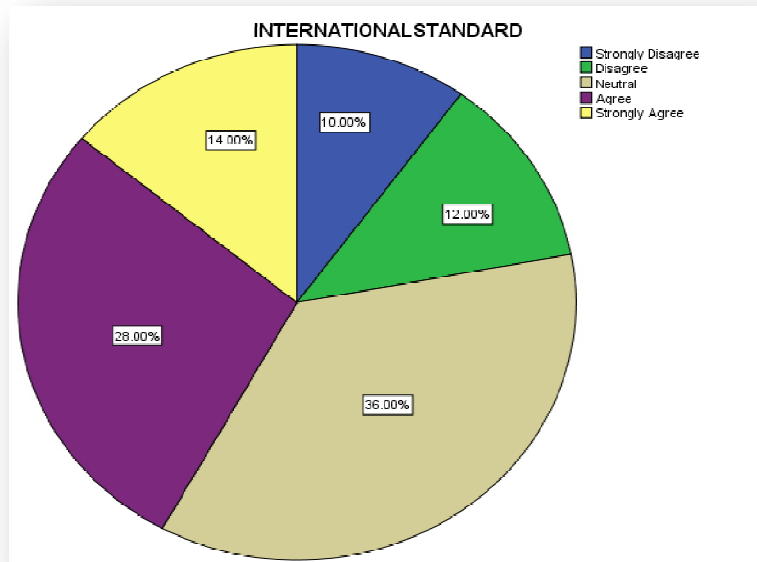
Figure 4-24: international standard's answers percentage, source prepared by the researcher(SPSS tool)

The figure (4-24) explains the international standard's answers percentage Which (36%) neutral, (28%) agree and (12%) disagree.

(36%) neutral, soSudan airways must put the effective plans lead to visible and tangible results.

(28%) agree this is due to IOSA program it is international and hence the implementation of it makes company comply with international standards and regulations and Sudan air is implementing it and has IOSA operator's certificate see appendix F.

Q15: The Implementation of IOSA program in Sudan airways leads to put safety policies and committed it?
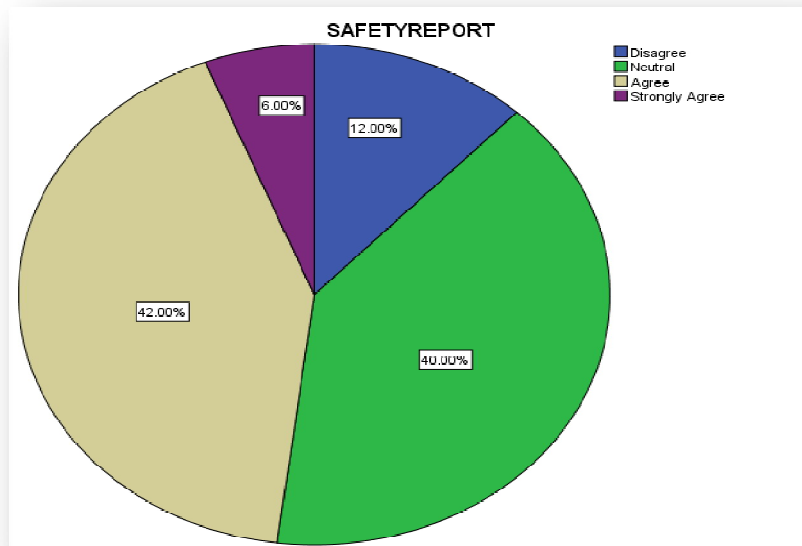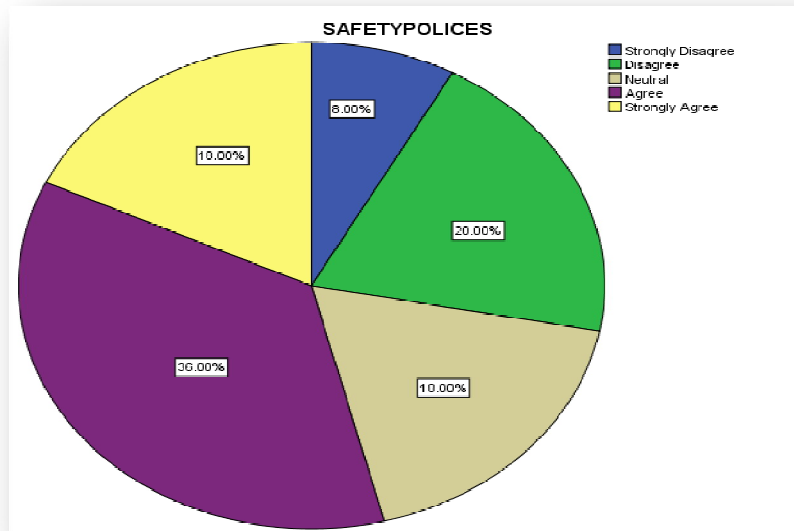

Figure 4-25: safety policies' answers percentage, source prepared by the researcher (SPSS tool)

The figure (4-25) explains the safety policies' answers percentage Which (36%) agree and (20%) disagree.

(36%) agree this is due to Sudan air has a corporate safety policy that reflects the organizational commitment regarding safety; includes a statement about the provision of the necessary resources for the implementation of the safety policy.

4.3.4 Hypotheses Test:

Using Chi Square (χ^2) Test we found the following results:

To explain the direction ofresponse median was determined. According to statistical analysis requirements changed all the nominal variables to quantitative variables, and used the chi square test to prove hypotheses to accept or reject the null hypothesis H_0 and alternative hypothesis H_1 .

No.	Question	Median	Answer
1	Team Work	4	Agree
2	Reduces Cost	3	Neutral
3	Management System	3	Neutral
4	Improve Environment	3	Neutral
5	Training	3.5	Agree
6	Customer Satisfaction	3	Neutral
7	Service development	3	Neutral
8	Quality Awareness	3	Neutral
9	Frequent Flying	2	Disagree
10	Periodic Maintenance	3	Neutral
11	Reduces Accidents	4	Agree
12	Safety Reports	3	Neutral
13	Emergency plan response	3	Neutral
14	International Standard	3	Neutral
15	Safety polices	4	Agree

Table 4:15 the median of each statement

First Hypotheses:4.3.4.1

H_0: There is no impact of implementation of IOSA audit program on airlines organizational performance.

H_1: There is an impact of implementation of IOSA audit program on airlines organizational performance.

No.	Question	Chi Square	DF	Median
1	Team Work	32.6	4	4
2	Reduces Cost	8.4	4	3
3	Management System	5.8	4	3
4	Apply Requirements	25	4	3
5	Qualified Personal	11.4	4	3.5

Table 4-16: Chi square test statistics for firstHypothesis , source prepare by researcher (SPSS)

Analysis of table's results:

- The calculated chi square value in the first statement (32.6) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and(5%) level of significant .depend on the above table(4-16) that denote to statistic significant different at (5%) level between sample's answers which supports the agreers in the first statement.

- The calculated chi square value in the second statement (8.4) which it is smaller than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to not significant different at (5%) level between sample's answers which supports the neutralists in the second statement.

- The calculated chi square value in the third statement (5.8) which it is smaller than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to not significant different at (5%) level between sample's answers which supports the neutralists in thethird statement.

- The calculated chi square value in the fourth statement (25) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the neutralists in the fourth statement.

- The calculate chi square value in the fifth statement (11.4) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the agreers in the fifth statement.

- The calculated chi square value of all samples of the first hypothesis (54.56)which it is greater than chi square tableau value (9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote tosignificant different at (5%) level between sample's answers which supports the neutralists of the first hypotheses .

from above we conclude the first study hypothesis which state that

"There is an impact of implementation of IOSA audit program on airlines organizational performance" it achieved and supports the neutralists of hypotheses.

Second Hypotheses: 4.3.4.2

H_0: There is no relationship between IOSA audit program and qualityof services and products improvement.

H_1: There is a relationship between IOSA audit program and quality of services and products improvement.

No.	Question	Chi Square	DF	Median	Answer
1	Customer Satisfaction	9.8	4	3	Neutral
2	Service development	11.4	4	3	Neutral
3	Quality Awareness	17	4	3	Neutral
4	Frequent Flying	15.6	4	2	Disagree
5	Periodic Maintenance	7.4	4	3	Neutral

Table 4-17: Chi square test statistics for second Hypothesis , source prepare by researcher (SPSS)

Analysis of table's results:

- The calculated chi square value in the first statement (9.8) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and(5%) level of significant .depend on the above table (4-17)that denote to significant different at (5%) level between sample's answers which supports the neutralists in the first statement.

- The calculated chi square value in the second statement (11.4) which Itis greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote tosignificant different at (5%) level between sample's answers which supports the neutralists in the second statement.

- The calculated chi square value in the third statement (17) which it is Greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote tosignificant different at (5%) level between sample's answers which supports the neutralists in thethird statement.

- The calculated chi square value in the fourth statement (15) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the disagrees in the fourth statement.

- The calculated chi square value in the fifth statement (7.4) which it is smaller than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to not significant different at (5%) level between sample's answer which supports the neutralists in the fifth statement.

- The calculated chi square value of all samples of the second hypothesis (34.92)which it is greater than chi square tableau value (9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote tosignificant different at (5%) level between sample's answers which supports the neutralists of the second hypotheses .

from above we conclude the second study hypothesis which state that

"There is a relationship between IOSA audit program andquality of service and products improvement" it achieved and supports the neutralists of hypotheses.

4.3.4.3 Third Hypotheses:

H_0: There is no impact of IOSA audit program on the safety of the international air transport.

H_1: There is impact of IOSA audit program on the safety of the international air transport.

No.	Question	Chi Square	DF	Median	Answer
1	Reduces Accidents	14.8	4	4	Agree
2	Safety Reports	20.88	3	3	Neutral
3	Emergency plan response	9.04	3	3	Neutral
4	International Standard	13	4	3	Neutral
5	Safety polices	10.02	4	4	Agree

Table 4-18: Chi square test statistics for thirdHypotheses , source prepare by researcher (SPSS)

Analysis of table's results:

- The calculated chi square value in the first statement (14.8) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table(4-18) that denote to significant different at (5%) level between sample's answers which supports the agreers in the first statement.

- The calculated chi square value in the second statement (20.88) which It is greater than chi square tableau value(7.81) at (3) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the neutralists in the second statement.

- The calculated chi square value in the third statement (9.04) which it is greater than chi square tableau value(7.81) at (3) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the neutralists in the third statement.

- The calculated chi square value in the fifth statement (10.02) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the agreers in the fifth statement.

- the calculated chi square value in the fourth statement (13) which it is greater than chi square tableau value(9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote to significant different at (5%) level between sample's answers which supports the neutralists in the fourth statement.

- The calculated chi square value of all samples of the third hypothesis(78.56)which it is greater than chi square tableau value (9.49) at (4) degree of freedom and (5%) level of significant .depend on the above table that denote tosignificant different at (5%) level between sample's answers which supports the agreers of the third hypotheses .

from above we conclude the third study hypotheses which state that

"There is an impact of IOSA audit program on the safety of the international air transport"it achieved and supports theagreers of hypotheses.

All the hypotheses are right at significant level (5%) and95% degree of confidence.

Note:

- The chi square tableau values see appendix G.

-The Questionnaire see appendix H.

Analysis discussions:4.3.5

- The statistical analysis proved the achievement of hypotheses but the trueness of achievedhypotheses   it isn't denote to the strong impact or relationship between variables of thehypotheses; As in the first hypothesis" there is an impact of IOSA auditprogram on organizational performance", second hypothesis " there is no relationship between IOSA audit program andquality of services and products" and the third hypothesis " there is impact of IOSA audit program on safety".

- The study of population and hypothesis results; indicate to the first and second hypothesis achieved and support the neutralists ,the third hypothesis achieved and support the agreers.

- So the trueness of the first and second hypothesis indicates to the impact and relationship statistically but not actually.
This is due to problems and difficulties faced the company and this led to thedecrease of the impact of IOSA program on performance and decrease of relationship between IOSA audit program and the quality of services and products.

- The trueness of the third hypothesis indicate s to the impact of IOSA audit program on safety which achieved and support the agreers.

From above we conclude the Sudan airways must put the effective plans lead to visible and tangible results to ensure the effective implementation of the program and eliminate from the deficiencies and shortages by implementing allits requirements properly and interesting from its benefits.

4.3.6Study results:

The analysis of questionnaire explained that Sudan air achieved some requirements and fail in others.

The company shall:

1-Put effective strategies and plans to reduce the cost.

2-Put effective management system is fully implemented and functional with a clear consistency and unity of purpose between corporate management and management in the operational areas.

3-Ensure the existence of the facilities, workspace, equipment and supporting services, as well as work environment, necessary to satisfy operational safety and security requirement.

4-Use the effective strategies to ensure customer satisfaction by meeting their needs and expectation through enhance and improve it is services and improve the level of service due to train its staff and provide suitable equipment.

5-Obligation by the schedule flights by purchasing aircrafts or lease it and hence it will ensure the loyalty of its customer and avoid the delay.

6-Ensure equipment or other operational products relevant to the safety or security of aircraft operations that are purchased or otherwise acquired from an external vendor or supplier meet the product technical requirements specified by the Operator prior to being used in the conduct of operations or aircraft maintenance and it should do periodic checks and maintenances for aircrafts and equipment.

4.4 Theme Four: Conclusions and recommendations:

4.4.1 Conclusions:

The need for uniform audit standards that will be recognized by airlines through world has led to development and implementation of IOSA. IOSA program with quality audit principles, standardized audit methodology and structured auditor qualifications standards is enabling airliners and regulators to share and accept audit results as valid, cost reducing and to avoid audit redundancy.

All the states shall implement the audit program to promote the aviation safety nationally and hence internationally.

It is obvious;the IOSA has significant role on aviation safety as described in research's chapters and it's contribute to promote the performance and quality of airline and reduces its cost and expenses.

Sudan as contract state should comply to the safety policies and requirements.

Unfortunately, this program it is rarely implementing in Sudan; except in Sudan airways since2008, the lack of implementation of safety programs in Sudan reflected the low degree of safety in Sudanese airports, the research displayed the problems and difficulties facing company to implement safety programs effectively in order to ensure safety and reliability in it is service,. Add to that the political and economic factors effecting in the effective implementation. Although Sudan air ways has IATA certificate but still it has outstanding problems that may affect negatively to the applied of IOSA standards such as: ((refer to chapter four, theme 2)).

4.4.2 Recommendations:

In the area of global airline alliances, code-share and other commercial agreements, safety and quality standards are prone to deterioration. Standards produce control and transparency by making quality measurable and revealing differences among competitors. Effective tool in determination of safety and quality standards level is audit.

As illustrated;   to be the one of IATA's member has many advantages that allow airline to develop its performance and improve the quality so:

First: Sudan civil aviation should:

1- Encourage all airlines and company to implement the IOSA and eliminate from the barriers and difficulties.
2- Accept IOSA program as benchmarking for aviation safety.
3- Disseminate the concepts of safety and quality in all disciplines.

Second: The government represented by the ministry of finance should:

 support Sudan airways as national carriers financially provide it with all the facilities from government fees, and provide payment of debt internally and externally and its commitment to develop clear plans for renewal of aircraft fleet and provide the aircrafts spare parts and help company to depend on qualified and experts national personnel they left company by satisfied them.

Third: Sudan airways should ensure the effective implementation of IOSA and reflectthat by:

1-Repair and maintain all equipment and facilities and renew it.

2-Set a clear strategy focus on improving safety in ground handling and all company's sections.

3-Improve performance and enhance the level of safety and improve it is reputation and financial situation to strengthen it and compete strongly to do its mission as national carriers.

4-Top management commitment to raise staff efficiency by training motivation and empower them to ensure their loyalty and creative.

4.4.3 Sources and Reference:

First: Sources:

- The holy Guran.

Reference:Second:

1- Dario Fakleš, Tomislav Gradišar and Sanja Steiner,IATA Operational Safety Audit (IOSA) in function of safety, Croatia, 2004.

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8-IATA, IOSA Procedures & Guidance for Airlines Manual,Montreal; Canada, Edition 2 – May 2014.

9-IATA, IOSA Standard Manual(ISM) Ed 9, Montreal; Canada, September 2015.

10-IATA, IOSA Q5AIMS Audi tee Manual,Montreal; Canada Ed 2, 18 June 2013.

11- IATA, operation safety conference, ParisFrance, 5-7 May2015.

12-international civil aviation organization, Universal Safety Oversight Audit Program Continuous Monitoring g Manual,Montréal, Canada, third eddition2011.
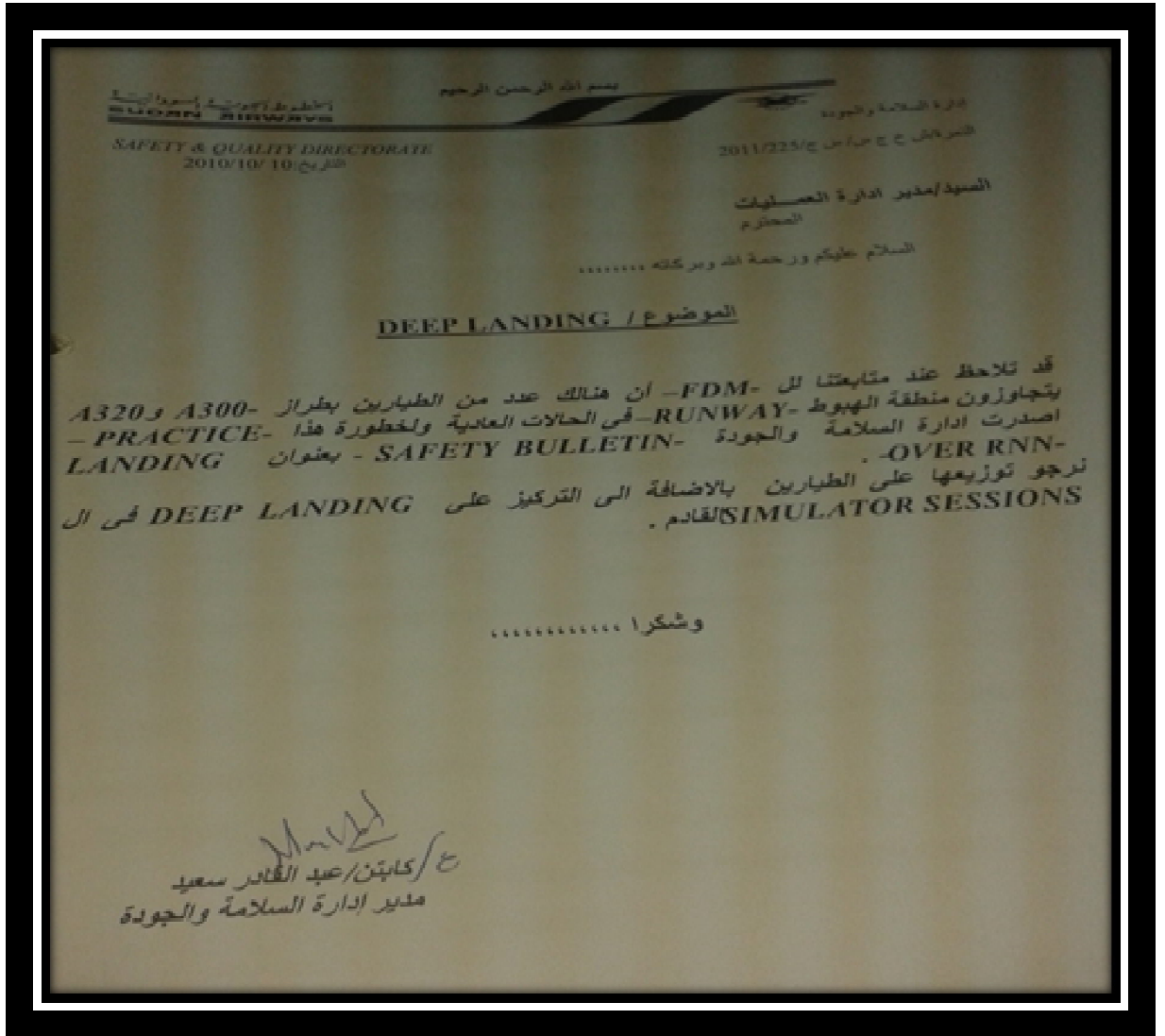
13- MirgahniMahmoud, Sudan airways IOSA manager, Sudan, 2016.

14- UK Civil AviationAuthority, Flight Data monitoring, UK, 2013.

APPENDIXES

Appendix A:explain how Sudan airways interested from FDM analysis in deep landing training

Appendix B: Sudan airways aviation safety bulletin

Appendix C: Sudan airways safety report

بسم الله الرحمن الرحيم

الخطوط الجوية السودانية
SUDAN AIRWAYS

OPERATIONS DIRECTORATE

اداره العمليات

To   : A320 Fleet Manager
From   : OPS. Director
Our Ref. : SUD/A320-2011
Date   : 25/07/2011

Subject : A320 Deep Landing

I would like to draw your attention to the out come and report of the FDM (Flight Data Monitoring) Programme, this programme analysis showed quite considerable numbers of the A320 Landings which were classified as deep landings that is beyond the touch down zone.

Would you please take this matter seriously and feed back the corrective action and remedy for this practice, bearing in mind Run Ways are still dry, and the Rainy Season is already very close.

Looking for a very prompt and quick action and feed back.

Capt. Osman El Syed
Operations Director

c.c. Safety & Quality Manager

Appendix D: Sudan airwaysFDAnotification form

	SUDAN AIRWAYS SAFETY & QUALITY DIRECTORATE	FDA Notification Form	Form Ref No:- 7106

Aero byte Analysis (*The FDA program is a non-punitive program. This form is a notification to operational personal for a de-identified data revision*)

A/C TYPE:- A 300	A/C REG:- ST-ATB	AIRPORT:- KRT

FLIGHT PHASE

☐	ENGINE START		☐	APPROACH
✓	TAXI OUT		☐	FINAL APPROACH
■	TAKE OFF		☐	LANDING
☐	INITIAL CLIMB		☐	GO AROUND
☐	CLIMB		☐	TAXI IN
☐	CRUISE		☐	ENGINE SHUTDOWN
☐	DESCENT		☐	WHOLE FLIGHT

SPECIFIC PARAMETERS high Taxi speed before T/O — 33 Kts.

ATTACHED List of event ☐ events report ■ **Flight snapshot**

S&Q Director Signature: Capt .A .A. Saied 15/9/2011

Operations Sector (Action to be taken by Flt Ops)

Action	✓ No action required	
	☐ Issue Ops bulletin	
	☐ Flight identification required	
	✓ Interview with captain & F/O required at Flt Ops. department	
	☐ Interview with captain & F/O required at S&Q department	
Fleet Manager Signature:-		Date:-
Director FLT Ops Signature:-		Date:- 17/9/2011
Safety & Quality Director Remarks/ Signature & Date:-		

This form shall be returned to Safety & Quality directorate for action required

No action, but when investigated, it was due to ATC (TWR) instruction to expedite Taxi due other landing Traffic

Non Punitive

SD/ SQ/FDA/ 02   REVISION 00   ISSUE 01   DATE : DEC. 2009   Page 1 Of 1

Appendix E: FDManalysis for Engine Pressure Ratio (EPR)
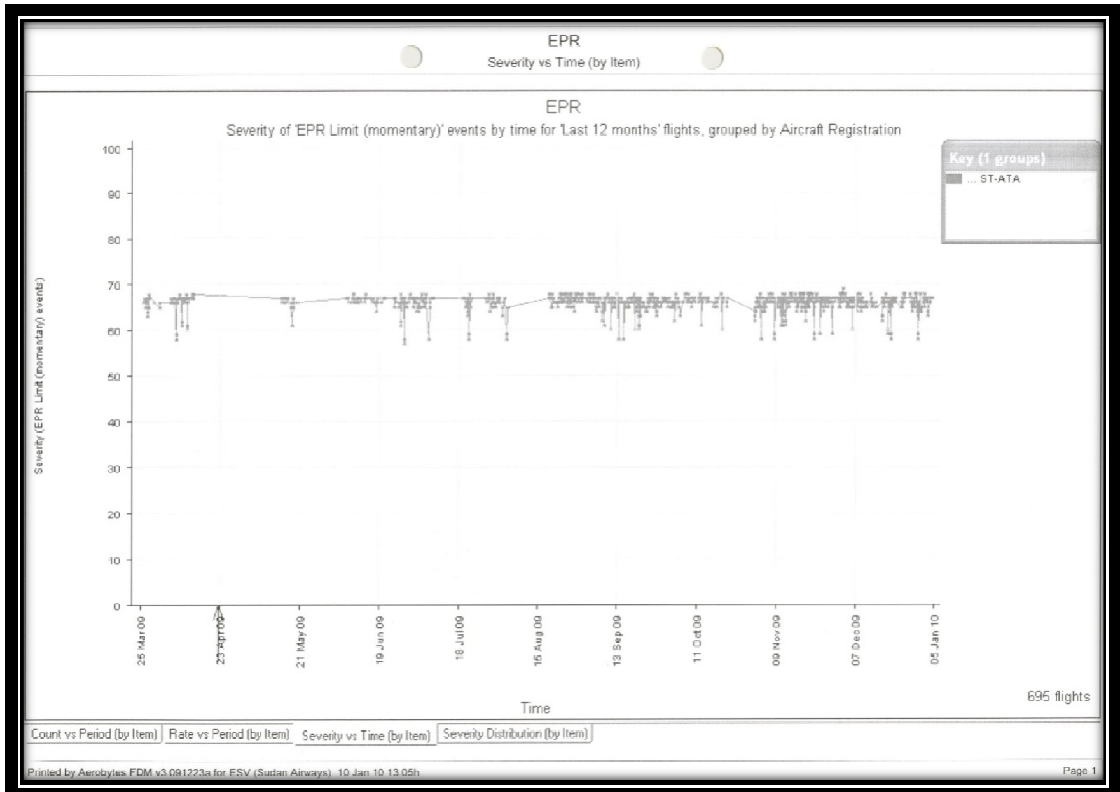
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AppendixF: Sudan airways' IOSA operator certificate2014

AppendixG: chi square tableau values used in analysis.

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81
7	1.239	2.167	2.833	4.255	6.346	9.04	12.02	14.07	18.48
8	1.647	2.733	3.490	5.071	7.344	10.22	13.36	15.51	20.09
9	2.088	3.325	4.168	5.899	8.343	11.39	14.68	16.92	21.67
10	2.558	3.940	4.865	6.737	9.342	12.55	15.99	18.31	23.21
11	3.053	4.575	5.578	7.584	10.341	13.70	17.28	19.68	24.72
12	3.571	5.226	6.304	8.438	11.340	14.85	18.55	21.03	26.22
13	4.107	5.892	7.042	9.299	12.340	15.98	19.81	22.36	27.69
14	4.660	6.571	7.790	10.165	13.339	17.12	21.06	23.68	29.14
15	5.229	7.261	8.547	11.037	14.339	18.25	22.31	25.00	30.58
16	5.812	7.962	9.312	11.912	15.338	19.37	23.54	26.30	32.00
17	6.408	8.672	10.085	12.792	16.338	20.49	24.77	27.59	33.41
18	7.015	9.390	10.865	13.675	17.338	21.60	25.99	28.87	34.80
19	7.633	10.117	11.651	14.562	18.338	22.72	27.20	30.14	36.19
20	8.260	10.851	12.443	15.452	19.337	23.83	28.41	31.41	37.57
22	9.542	12.338	14.041	17.240	21.337	26.04	30.81	33.92	40.29
24	10.856	13.848	15.659	19.037	23.337	28.24	33.20	36.42	42.98
26	12.198	15.379	17.292	20.843	25.336	30.43	35.56	38.89	45.64
28	13.565	16.928	18.939	22.657	27.336	32.62	37.92	41.34	48.28
30	14.953	18.493	20.599	24.478	29.336	34.80	40.26	43.77	50.89
40	22.164	26.509	29.051	33.660	39.335	45.62	51.80	55.76	63.69
50	27.707	34.764	37.689	42.942	49.335	56.33	63.17	67.50	76.15
60	37.485	43.188	46.459	52.294	59.335	66.98	74.40	79.08	88.38

Appendix H: The Questionnaire

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بسم الله الرحمن الرحيم

SUDAN UNIVERSITY OF SCIEINCE

AND TECHNOLOGY

Total Quality & Excellence Center

MSc in Management of Quality & excellence

</div>

Dear all,

The researcher is studying the impact of implementation of IATA Operational Safety Audit (IOSA) program on safety in Sudan airways, as a requirement to achieve master's degree in Total Quality Management.

Kindly, supply your opinions and valuable participation to fill this questionnaire according to your experience and knowledge. Your contribution is helpful to accomplish this research, and will be an added value to science and knowledge.

All the information in this survey is only used for scientific research purpose and we will keep it as top confidential.

Thanks a lot for your cooperation which is highly appreciated

With best regards,

Researcher:

Mai Mohammed Elsair Mahla

A-personal characteristics:

Please tick (√) in a circle that acts your situation:

1-Name (optionally) …………………………

2- gender:

- ○ Male
- ○ Female

3- Age:

- ○ 20 -30
- ○ 31-40
- ○ 41-50
- ○ 51 and above

4-Exeperience:

- ○ 1-5 year
- ○ 6-10year
- ○ 11-15 year
- ○ More than 15 year

5-Position:

- ○ Director
- ○ Head section
- ○ technician
- ○ Employee

B-Please tick ($\sqrt{}$) in a column that contains your answer:

	Impact of IOSA on performance					
Number	**Expression**	**Strong agree**	**Agree**	**Neutral**	**Disagree**	**Strong disagree**
1-	The Implementation of IOSA program creates framework involving teams to facilitate the standard development process in Sudan airways					
2-	The Implementation of IOSA program reduces the cost in Sudan airways					
3-	The Implementation of IOSA program creates management system ensures the control of process and safety management in Sudan airways					
4-	The Implementation of IOSA program creates suitable environment for work ; which the company provides all facilities and equipment that's require for accomplish work properly.					
5-	The Implementation of IOSA program in Sudan airways creates the qualified personnel through the continue training and education					

	Impact of IOSA on quality of service and process						
Number	**Expression**	**Strong agree**	**Agree**	**Neutral**	**Disagree**	**Strong disagree**
6-	The Implementation of IOSA program in Sudan airways leads to customer satisfaction(internally and externally)					
7-	The Implementation of IOSA program in Sudan airways develops the quality of services (catering, customer service….)and process					
8-	The Implementation of IOSA program disseminates the quality awareness in Sudan airways					
9-	The Implementation of IOSA program encourages the frequent flying which the flights meeting timescale (departure and arrival)					
10-	The Implementation of IOSA program encourages company to possess valid equipment which it was checked and maintained periodically(tugs, high loader..) and aircrafts					

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Impact of IOSA on safety						
Number	**Expression**	**Strong agree**	**Agree**	**Neutral**	**Disagree**	**Strong disagree**
11-	The Implementation of IOSA program in Sudan airways reduces the aircraft accidents					
12-	The Implementation of IOSA program in Sudan airways encourages employees to write the safety report for all abnormal events and hence contribute in risk analysis and eliminate					
13-	The Implementation of IOSA program in Sudan airways makes it has emergency response plan					
14-	The Implementation of IOSA program make company comply to international standards and requirements in safety					
15-	The Implementation of IOSA program in Sudan airways leads to put safety policies and commit by it					

Arbitrators:

-**D.** AHMED MUSA

Open OfSudan University

-**D.**HASSAN SALMAN

Omdurman Islamic University, Unisco Water Chair.