

FORMAL SAFETY REPORTING SYSTEM AND GOAL ATTAINMENT IN NIGERIAN AIRSPACE MANAGEMENT AGENCY (NAMA)

PROF. COSMAS CHIBUIKE ALUGBUO

Department of Management,
Faculty of Management Sciences,
Imo State University, Owerri,
Nigeria.

&

NWAOBILOR CHIMA ALLOIS

Department of Management,
Faculty of Management Sciences,
Imo State University, Owerri,
Nigeria

Abstract:

The study focused on formal safety reporting system and goal attainment in Nigerian Airspace Management Agency (NAMA). Previous researchers on the topic did not address managerial concerns like flight timeliness and incident control as measures of goal attainment nor examine maintenance reports and traffic control reports as key indices of formal reporting system. The specific objectives of the study were to examine the extent of relationship between formal safety reporting system and goal attainment in NAMA using the identified indices. To realize these objectives, basic research questions were asked that led to the formulation of null hypotheses to guide the study. Descriptive survey design was adopted to suit the collection of data from the 203 employees that were judgmentally sampled in the five airports located in the South-East and South-South geo-political zones of Nigeria, with the use of structured questionnaire, based on the researcher's understanding of the Agency. The hypotheses were tested with the Pearson's Product Moment Correlation to evaluate the relationship between the variables. Based on the findings, the study concluded that formal safety reporting system has significant positive relationship with goal attainment in NAMA and the study recommends that; Maintenance reports should be timely and very apt in order to ensure flight timely operations among others.

Keywords: Formal safety reporting, goal attainment, maintenance report, traffic control report, timelines, incident control.

Introduction:

The core mandate of aerospace management in Nigeria is safety. The safety of the passengers, cargo, the cabin crew members and the aircraft, cannot be compromised. Formal

safety reporting system is a formal process, which follows a laid down set of rules and regulations. It is one method expected to increase safety conditions and reduce incidents and accidents. By formal safety reporting, we mean the official filing of reports and collection of information on actual or potential safety deficiencies.

Safety occurrence is a term used to describe all events which has or could have significance in the context of aviation. Safety occurrence in this regard, ranges from serious incidents or events that must be reported; to occurrences of lesser severity which in the opinion of the reporter could have safety significance.

The aim of safety reporting in aviation sector is to improve the safety of aircraft operations by timely detection of operational and system deficiencies. It plays an essential role in accident prevention, enabling the identification of appropriate remedial actions through prompt analysis of safety data and by exchange of safety information.

International Standard for Aviation Safety Reporting (ISASR 2012), which relates to the implementation of safety systems, has it that all aviation service providers must develop and maintain a formal process for collecting, recording actions and generating feedback about hazards in airlines operations. ISASR (2012) stipulates that the process must be based on a combination of reactive, proactive and predictive methods of safety data collection.

Aviation Agencies have a legal responsibility to report to their supervisory ministry (in this case, the Federal Ministry of Aviation, Nigeria), all accidents or serious incidents they are aware of. Additionally, operational personnel are required to report certain categories of safety deficiencies to their employers and to Nigerian Civil Aviation Authority (NCAA), the Aviation Regulatory Agency in Nigeria and other stakeholders such as the National Emergency Management Agency (NEMA), under a national mandatory reporting scheme.

An airspace formal reporting system contains: standard operating procedure (SOP), safety management procedures, cabin report, captain trip report, security report, maintenance report and air traffic control report, amongst few other report typologies (Charlotte, Cook, Richard, Wood and Miller, 2018).

Cabin reports specify crew names, weather conditions, runway lighting, flight phase, flight operation dates and cabin activity during an incident, among other fields. Trip reports are similar to cabin crew reports but must be provided by the pilots and signed by the Chief Pilot. Maintenance report specifically addresses air worthiness of the aircraft as a proactive safety practice. Security reports provide information on security of lives and cargo on board of the aircraft and at the airport terminal buildings. Air traffic control report provides information on fields related to altitude and motion of the aircraft in the air or space (Hardy, 2020). Safety reporting system is maintained to create impact on the attainment of organizational goals.

Goal attainment in the other hand in airspace management, revolves around efficient, effective and economic provision of navigational services that lead to safe take-off and landing of aircrafts, timely service delivery, aeronautic information system, seamless ground-to-ground and ground-to-air communication, functional 24/7 navigational and surveillance system and accident/incident control mechanism.

An incident is a disruption of flight operations. Incident control is a proactive practice of drawing up appropriate and emergency plans in preparation for serious incidents. The top priority of airspace mandate is safety of air operations.

Statement of the Problem

The issue of safety in the aviation sector and its effects on organizational outcomes has been examined by researchers from various perspectives. Perrow (2019) examined safety culture and its economic impact on New Delhi Aerospace Regulations Agency. Ojo (2020) studied technical and operational flight factors and aviation safety in Nigeria. Glandon and Stauton (2020) studied the effect of environment on aerospace safety; Vermenlen and Pertorius (2016) studied the effects of informal safety discussions on effectiveness of aviation operations, among other studies in this regard. Thus, previous studies on aviation focused mostly on economic impact arising from the ability to effectively supporting global business. Where studies on aviation formal safety reporting or organizational goal attainment exist, for example that of Chen and Weng (2016), they do not address managerial concerns like flight timeliness and incident control as measures of goal attainment in airspace management; nor examine reporting variants like maintenance reports and traffic control reports as key variants of formal safety reporting system that play a major role in airspace safety. It is imperative therefore, to assess the extent of relationship between formal safety reporting system and goal attainment using these indicators such as maintenance report, traffic control report, incident control and flight timeliness.

Objectives of the Study

The broad objective of this study is to assess the extent of relationship between formal safety reporting system and goal attainment in Nigerian Airspace Management Agency, while the specific objectives are to;

1. evaluate the extent of relationship between maintenance report and incident control.
2. ascertain the level of relationship of traffic control report and incident control.
3. assess the extent of relationship between maintenance report and flight timeliness.
4. determine the impact of traffic control report on flight timeliness.

Research Questions

To enable the realization of the study objectives, the following questions were asked.

1. What is the extent of relationship between maintenance report and incident control?
2. What is the level of relationship between traffic control report and incident control?
3. To what extent does maintenance report relate with flight timeliness?
4. What is the degree of impact of traffic control report on flight timeliness?

Research Hypotheses

The hypotheses that were formulated to guide the study are stated in null form as follows:

- Ho₁:** Maintenance report has no relationship with incident control.
Ho₂: Traffic control report does not have significant relationship with incident control.
Ho₃: There is no relationship between maintenance report and flight timeliness.
Ho₄: Traffic control report has no impact on flight timeliness.

Review of Related Literature

Conceptual Review

Formal Safety Reporting System

Safety reporting in airspace management aims at improving safety of airspace operations by timely detection of operational and system deficiencies. Fang and Jossy (2021)

define formal safety reporting as the official filing of reports and collection of information on actual or potential safety deficiencies. Safety reporting is a formal process which follows a laid down set of rules and regulations. Safety reporting plays an essential role in accident prevention, enabling the identification of appropriate remedial actions by prompt analysis of safety data and by the exchange of safety information.

International standard for safety reporting which relate to the implementation of safety systems has it that all aviation service providers must develop and maintain a formal process for collecting, recoding, acting on/and generating feedback about hazards in operations. The process must be based on a combination of reactive, proactive and predictive methods of safety data collection. Airspace Navigation Service Providers (ANSPs), are statutorily required, as a laid down responsibility, to report to their national authorities all accidents or serious incidents of which they become aware. (Fang and Fossy, 2021). A typical formal safety reporting system in aviation management has been identified by Charlotte, Cook, Richard, Wood and Miller (2018) to include Cabin safety report, Captains trip report, Maintenance report, Security report, Traffic control report and Airport safety report.

Goal Attainment

Cox and Gritten (2008) define goal attainment as a measure of how an organization achieves its goals. According to Cox and Gritten, organizational goals are attained when the goals of subunits (such as group goals) are specifically directed and coordinated. Cox and Gritten believe that goal attainment is an indicator of organizational effectiveness. The more efficiently, effectively and economical an air navigation service provider achieves its goals, the more successful it is according to the goal attainment approach to organizational effectiveness. Measuring the goal of an organization will always lay credence to what the objectives of the organization are (Mc Can 2014). In aviation, however, goal attainment is viewed fundamentally from air safety dimension which include, safety of the flying public, provision of navigational, surveillance and communication services and air traffic management, (Hardy, 2020; Henry, 2011, Mc Can, 2014, Federman, 2016).

Flight Timeliness

Timely departure and arrival or flight timeliness is defined by Zhou, Fang and Mohammed (2019) as the arrival of aircraft at the destination gate earlier than or exactly on scheduled time. Hale (2010) uses the concepts 'punctuality', 'timeliness' and 'timely delivery' interchangeably. According to Hale, punctuality statistics is one of the responsibilities of aerospace management. Such record keeping provides data for the control of time delays and overall management of flight timing. In Europe, the body saddled with the responsibility of flight time management is the Central Office for Delay Analysis (CODA) which generates periodic data on the punctuality of flights in that continent. CODA (2021) discloses that the Euro-Aerospace Industry (EAI) recorded an impressive 78% on-time flights in the year 2020, despite the delays and interruptions occasioned by the COVID-19 pandemic in that year. A similar Agency for the measurement of flight traffic and timeliness in Nigeria is the Nigerian Civil Aviation Authority (NCAA) which is the regulatory body under the supervision of the Federal Ministry of Aviation.

Jossy and Ross (1998) conducted a study that threw light on how flight punctuality is measured. The study identifies the major parameter of air traffic punctuality as Air Traffic Flow Management (ATFM) delay which is the air traffic control portion of the process. ATFM delay is used to measure the effect of delays on flight performance in the en-route and approach phases. It takes into account of any postponed departure times, traffic situation of the airspace and weather report at the destination airport.

Incident Control

Hale (2010) defines incident control as a proactive measure taken to draw up appropriate emergency plans in preparation for serious incidents. An airline's top priorities cannot be far from issues of safety and safe operations. In the case of disruption to flight operations, the highest priority is the rapid response and immediate launch of appropriate actions to restore operations as quickly as possible. Hale (2010) depicts that contingency, continuity and risk awareness are all parts of efficient and proactive incidence control in airspace management. According to Hale, tools to facilitate the management of such disruptions such as severe weather, security threats, accidents, etc., are becoming increasingly important. During such events, the operators concerned must respond rapidly to return to regular operations at the earliest possible time. So, the facilitation of organizational standardization and practical stepping stones through a structured and disciplined formal reports system is of immense value (Charlotte, Cook, Richard, Wood and Miller, 2018). 2.2

Theoretical Review

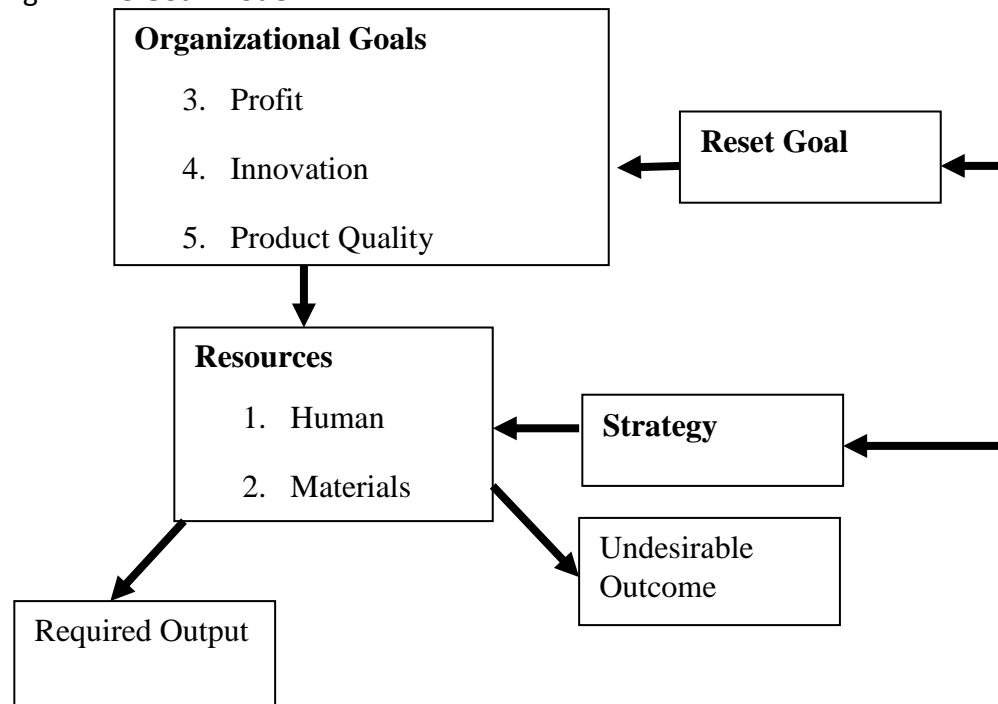
The Flight Safety Margin Theory

Jing (1998) propounded the Flight Safety Margin Theory, The basic motivation is to establish an approach to reveal how safe a given flight is from a geometric prospect. This prospect attempts to describe how much distance is left for an accident to occur. The theory envisages human error as the core concern of flight safety, making it imperative to establish a theory of flight safety from the point of view of operators. Jing describes the principle of safety as room for error and defines flight safety margin as the room for error or mistake in flight. In the course of the flight safety margin theory an abstract situation space is defined first. All the situations related to flight safety constitute the space representing the set of all possible outcomes. In this space, according to Jing, any combination of parameters is represented by a point. A point represents a specific situation of flight. At any given instant, the distance between the present situation and the accident boundary can be used as a safety measure. This distance implies how far the present situation is from the occurrence of an accident. Hence the distance is defined as the flight safety margin.

The Goal Model Theory

The goal model is one of the most widely used models in organizational effectiveness. It focuses on output to figure out the essential operating objectives like profit innovation and product quality. The modified model of the theory was proposed by Schermerhorn, Aunt, Osborn (2004), and the basic assumptions of the model is that there should be a general agreement on the specific goals of an enterprise and that the people involved should feel committed to fulfill the goals. The next assumption is that the number of goals is limited and achieving them requires certain indispensable resources.

Fig. 1: The Goal Model



(Source: Schermerhorn et al (2004))

However, Altschuld and Zheng (2005) argue that the weakened significance of the goal model for the evaluation of effectiveness of organizations is accentuated in the accuracy and clarity of measurement results which depend on the vividness of the goal and output measures. Thus, the goal model is suitable only where goals are vivid and output measures are aliens (Altschuld and Zheng 2005; Schermerhorn, Hunt and Osborn, 2004).

Empirical Review

Zhou, Fang and Mohammed (2021) examined the consistency of aviation safety culture questionnaire over a three year period at a Chinese construction company. Construction workers at the Chinese construction company were given a survey of safety culture in 2011 and again in 2014. The survey consisted of 87 items asking about key aspects of safety culture within the organization. The researchers performed a factor analysis on the items for both years and found out that both years comprised the same four factor safety culture, (1) safety regulations, (2) safety supervision (3) management commitment and (4) safety attitude, at the same level of significance. The differences, however, became insignificant when after the construction workers had been subjected to safety training for a period of two weeks. The researchers concluded that safety awareness had a significant negative impact on production errors.

Christian, Cabrella, Niscana, Isla and Viela (2020) carried out a comprehensive study on multi-dimensional organizations in New Delhi, in order to evaluate the strength of safety reporting as a predictor of unsafe behaviour and accidents. A 92 – item questionnaire was used to draw primary data which were analyzed by various statistical tools. The results emphasized multiple correlation between safety reporting (cabin reports, maintenance reports, security

reports, traffic reports, trip reports and safety issues in aviation), and attitude to violation (pilot negligent disposition, cabin errors, pilot commitment to safety standards and ethical leadership).

Nielsen, Pasmussen, Glasseock and Spangerberg (2018) examined two productive plants owned by a turbine, a manufacturing company in Andover. Despite being owned by the same company and producing the same products one plant had more significant errors than the other. It was found that the disparity was caused by differences in safety between plant A and plant B.

Liu and Daklar (2018) conducted a study on track maintenance operators' attitude versus objective accident data in aviation, using South Wales Flight Corporation as a case. The methodology of the study involved a systematic sampling of 714 maintenance operators, in the South Wales Frack, Australia. Analysis of the data by means of statistical software packages showed a significant correlation between operators' attitude and accidents.

Zohar (2017) in addition to his earlier researches in 2000 that contributed to the study of safety in aviation as a discipline, conducted a criterion-based formal safety research to predict the effect of safety reports and informal group interactions on micro accidents. A total of 4055 subjects were involved in the study and the results of the statistical analysis established an empirical link between safety reports and micro accidents.

Research Methodology

Research Design

Descriptive survey design was used in the study. The study was an empirical examination of formal safety reporting and goal attainment of the Nigerian Airspace Management Agency (NAMA). The descriptive survey design was adopted to suit the collection of data from a specific group that constituted the research respondents.

Population of the Study

The population of the study was made up of 413 employees of the Nigerian Airspace Management Agency in five airports of the south-east and south-south geo-political zones. The population estimate was obtained through the help of a research assistant who surveyed the five airports. The population distribution is as follows.

Table 1 Population of the Study

Study Organization	Population
NAMA Port-Harcourt	120
NAMA Calabar	90
NAMA Owerri	86
NAMA Uyo	68
NAMA Enugu	49
Total	413

Sample Size Determination

The Taro Yamene statistical formula provided a guide to the determination of the sample size.

$$n = \frac{N}{1 + Ne^2}$$

Where:

n = Sample size, N = Population size, e = level of significance (5%).

$$\begin{aligned} \Rightarrow n &= \frac{413}{1 + 413 (0.05)^2} \\ &= 203 \end{aligned}$$

The study sample size was 203.

The sample proportion (k) drawn from each branch of the NAMA was determined as follows:

$$K = \frac{P \times n}{N}$$

Where P = Population of each branch;

Thus:

$$\text{NAMA Port-Harcourt} = K = \frac{120 \times 203}{413} = 59$$

$$\text{NAMA Calabar} = K = \frac{90 \times 203}{413} = 44$$

$$\text{NAMA Owerri} = K = \frac{86 \times 203}{413} = 42$$

$$\text{NAMA Uyo} = K = \frac{68 \times 203}{413} = 34$$

$$\text{NAMA Enugu} = K = \frac{49 \times 203}{413} = 24$$

Table 2 Sample Proportions

Organization	Population	Sample Proportion
NAMA Port-Harcourt	120	59
NAMA Calabar	90	44
NAMA Owerri	86	42
NAMA Uyo	68	34
NAMA Enugu	49	24
Total	413	203

Sample Techniques

Judgmental technique was used to select the employees of the Agency at south-east and south-south geo-political zones based on the researcher's understanding of the Agency in Nigeria, and its components in consideration of the objectives of the study.

Research Instrument

Structured questionnaire was used as data collection instrument. The questionnaire was constructed to elicit responses that were useful in answering the research questions and providing appropriate data for the test of the research hypotheses. The question items contained in the questionnaire follow a five-point Likert scale to which weights of 5 to 1 were attached from the Strongly Agree (SA) option to Strongly Disagree (SD). This scale had been tested for reliability and validity prior to administration.

Copies of the questionnaire were administered to the respondents in their workplaces. The intention of the study was explained to the respondents to increase the chance of eliciting unbiased responses. The instrument was administered to both the management and staff of the Nigerian Airspace Management Agency in the five chosen States. The respondents were allowed sufficient time to study the question items and provide their responses. The researcher was able to retrieve all administered instruments.

Data Analysis

Results

Table 3 Correlations

	MR	TCR	TSD	IC
MR	1.000			
TCR	0.522	1.000		
FT	0.760	0.624	1.0000	
IC	0.781	0.630	0.768	1.000

Dependent Variables: FT, IC

MR Maintenance Report

TCR Traffic Control Report

FT Flight Timeliness

IC Incident Control

Findings

Table 3 shows the correlational results of the dependent and predictive variables, with Pearson r as the test statistic. From the table, Maintenance Report (MR) records $r = 0.760$ and $r = 0.781$ respectively with FT and IC. Traffic Control Report (TCR) records $r = 0.624$ with FT; and $r = 0.630$ with IC. All correlation coefficients in each case are significant and positive. This suggests a positive relationship between formal safety reporting system (MR, TCR) and goal attainment (FT, IC).

These results are in one accord with those of Charlotte, Cook, Richard, Woods and Mitter (2018); and Hardy (2020). Charlotte et al (2018) discovered a direct positive correlation between safety system and performance of airports in the United Arab Emirates. This is sequel to several other findings such as those of Jasmin (2021) and Hardy (2020) that formal safety reporting system in aviation has a direct link with safety performance.

Based on the hypothesis tested using SPSS package version 2.0, the study discovered that formal safety reporting system has significant positive relationship with goal attainment in NAMA.

Conclusion

The study has provided empirical evidence to show that formal safety reporting system has a positive relationship with goal attainment in the airspace management in particular and aviation industry in general. Regular formal reporting systems in airspace management such as maintenance report and air traffic control report have been proven in this study to have positive relationship with goal attainment. Precisely, maintenance report and air traffic control report have Pearson coefficients of 0.764 and 0.624 with flight timeliness; and 0.781 and 0.630 with incident control respectively. Other statistical tests on the research data such as the analysis of variance showed that positive relationship exist between dependent and independent indices. The ANOVA yielded a Fisher's ratio of 14.660 which was highly significant compared with the critical value of 9.608 at the given level of significance and degrees of freedom.

The regression model summary yielded a coefficient of multiple determination of $R=0.5292$ with an adjusted squared value of 0.2650 (or 26.50%). A Durbin/Watson statistic of +2.316 observed in the test results depicts a negligible (and therefore acceptable) degree of autocorrelation among the correlational variables.

Based on the findings, the study concluded that formal safety reporting system in Nigerian Airspace Management Agency has significant positive relationship with goal attainment, with about 26.50% variations in goal attainment being accounted for by changes in formal safety reporting system.

Recommendations

The following recommendations are derived from the findings of the study.

1. Traffic control reports should be prompt as a proactive measure to incident control.
2. Maintenance reports should be timely and very apt in other to ensure flight timely operations.
3. Zero tolerance of flight incidents should be a priority in the strategic planning of the aviation industry by the availability of prompt incident reports.
4. Formal safety reporting system documents should be maintained and regularly updated to mitigate and control incidents as well as enhance flights timely operations.

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