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Philippine Air Transport Safety: Analysis of Incidents over the Last Two Decades

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Abstract: The main objective of the study is to raise awareness on the risk susceptibility of the general public on domestic air travel in the Philippines. Annual incident, fatal accident and fatality rates per 1 million landings from 1995 to 2015 were computed and compared to the global average rates. Since 2000, Philippines' average incident rate is 13.2, very high compared to the global average of 3.9. The fatal accident and fatality rates are both zero since 2003. Runway excursion during landing is the most frequent incident while controlled flight into terrain during descent has the highest fatality rate. Using IAOGP safety assessment mechanism, the safety scores of local airlines were computed using parameters such as management and operational environment factors. Airlines A and B scored 6.799 and 6.914, respectively. Comparing to international airlines, Philippine-based airlines are above average in terms of overall safety. Safety cultures in aerodromes were also identified.

Key words: Philippine aviation, safety, incident rate, fatality rate, airline safety

1. INTRODUCTION

1.1 Background

With its archipelagic characteristics, Philippines depends highly on air transportation systems which provide rapid and efficient connection between widely distributed areas, and thus supporting the social and economical development of the entire nation.

Being a colony of the United States right after the Spanish-American War of 1898, our country benefited from the rapid technological growth in which the United States was the principal forerunner. For years, several researches and experiments were done in the hopes of unraveling the mystics of flight, until the Wright brothers of Ohio introduced a significant aviation breakthrough with the first powered flight in 1903. Eight years later, the first powered flight took off in the Philippines and the country led the region in aviation development for the most part of the early stages of aviation.

Under the Department of Transportation and Communications (DOTC) are two agencies responsible for the aviation welfare of the country: Civil Aeronautics Board (CAB) and Civil Aviation Authority of the Philippines (CAAP). CAB is tasked to regulate, promote and develop the economic aspect of air transportation and to ensure that existing CAB policies are adapted to the present and future air commerce of the Philippines.

On the other hand, CAAP is responsible for implementing policies on civil aviation in order to ensure safe, economical, and efficient air travel. As an independent regulatory body with quasi-judicial and quasi-legislative powers, CAAP is mandated to set comprehensive, clear and impartial rules and regulations for the Philippine aviation industry.

The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations that codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth.

At present, there are three leading domestic air carriers in the country, namely Philippine Airlines, Cebu Pacific and AirAsia Philippines.

Figure 1. History of Philippine Airlines and PAL Express

Philippine Airlines, former Philippine Aerial Taxi Company, started its operations in 1941. In 2013, PAL acquired Air Philippines and rebranded it as PAL Express, as shown in Figure 1.

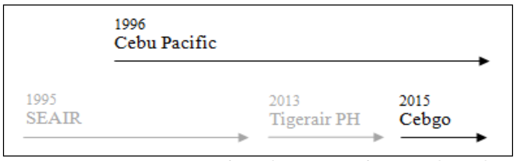

Figure 2. History of Cebu Pacific and Cebgo

As shown in Figure 2, Cebu Pacific began its operations in 1996. In 2015, Cebu Pacific acquired Tigerasia Philippines, previously known as Southeast Asian Airline, and renamed it as Cebgo.

Figure 3. History of AirAsia Philippines and AirAsia Zest

AirAsia Philippines commenced in 2010. In 2013, AirAsia Philippines acquired Zest Air, formerly known as Asian Spirit, and rebranded it as AirAsia Zest, as shown in Figure 3.

1.2 Statement of the Problem

Though aviation-related incidents are high profile news stories, studies on the main causes and trends of these incidents in domestic scale are lacking and/or not available to the public. With this, the need to have an in-depth study on the aviation safety is necessary.

1.3 Objectives

The main objective of the study is to raise awareness on the risk susceptibility of the general public on domestic air travel in the Philippines. In doing so, one of the specific objectives of the study is to identify the annual incident, fatal accident and fatality rates from 1995 to 2015 and compare these with the global average rates. Moreover, the study aims to establish aviation incident trends with respect to the types of occurrence and phases of operation using frequency and number of fatalities and injuries data.

Another specific objective of the study is to assess local airlines' safety using parameters such as management and operating factors and operational environment components. A subsequent objective is to identify the regulations and safety cultures in the runway operations of airports.

1.4 Significance of the Study

The study provided rates and trends that are essential in identifying the most vulnerable components in aviation with respect to different parameters. From these, the general public will be informed on the associated risks involved with air travel, together with the corresponding safety cultures and precautionary measures done by authorities in limiting these incidents.

1.5 Scope and Limitations

The study only covered domestic incidents from 1995 to 2015 concerning scheduled commercial passenger flights. Data are limited to what CAB and CAAP provided, and with the available ICAO reports. For the airline safety assessment, the subsidiary airlines are included to the parent airlines.

1.6 Framework of the Study

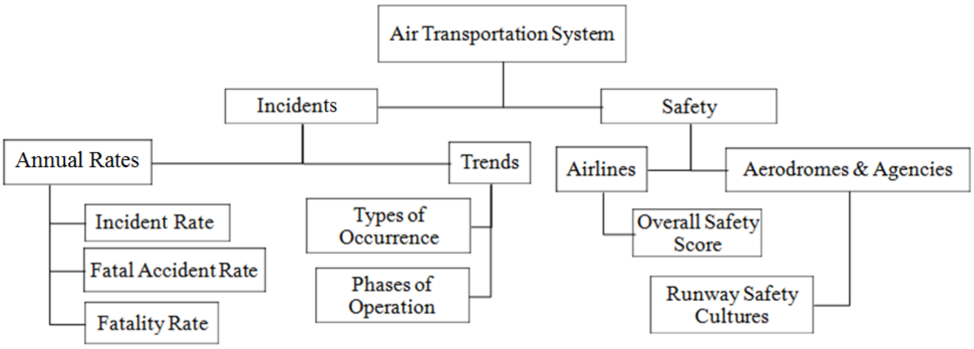

Figure 4. Framework of the Study

As shown in Figure 4, the study focused on two areas: incidents and safety in aviation. Under incidents, the rates and trends were identified. These include annual incident, fatal accident and fatality rates. The trends were categorized with respect to the types of occurrence and phases of operation. For the safety, the safety scores of local airlines and the safety measures recommended by agencies and practiced in aerodromes were identified.

2. REVIEW OF RELATED LITERATURE

According to the International Association of Oil and Gas Producers (IAOGP), operations by well-established and developed-world airlines are safer in general than those by less-established and developing-world operators. However, much of the evidence for this has remained un-analysed. Assessing the risks involved in using different airlines is based largely on reporting of a few well-publicised accidents viewed in isolation from their proper statistical context.

Furthermore, air travel has become one of the safest forms of travel on a distance-flown basis. However, because of the longer distances involved in air travel compared to most surface journeys, it is the accident rate per flight that is of most concern. There is also the problem of the smaller operators. The fact that they may not have experienced an accident may not be statistically significant and over-reliance on this fact may conceal underlying problems with air safety, with, to use a popular phrase – “an accident waiting to happen”. Larger operators do not have this problem: the accident may indeed be waiting to happen, but its occurrence does not generally significantly affect the overall accident rate, although it may hit the headlines (IAOGP, 2009).

In the ‘Paradoxes of Almost Totally Safe Transportation Systems’ of Amalberti, he stated that accidents actually do not happen very often. Most transportation systems in the developed world are safe or even ultra-safe. Their likelihood of a fatal accident is less than 10^{-7}, which means a one-out-of-10,000,000 chance of death, serious loss of property or environmental or economic devastation.

The regulatory powers of governments have a very significant influence in the air transport industry. This is strongly indicated today by the many stringent requirements of governments on matters of security and safety of flights operations brought about by the 911 incidents. These requirements put a heavy burden on airlines, many of which were not able to sustain operations and closed down (Zapanta, 2005).

According to the 'Commercial Aviation Safety' of Rodrigues and Cusick, the accident and its investigation remain the most conspicuous source of insights and information leading to accident prevention. Accidents provide compelling and incontrovertible evidence of the severity of hazards. The often catastrophic and very expensive nature of accidents provides the incentive for allocating resources to accident prevention to an extent otherwise unlikely.

Authorities should be extremely sensitive to the limitations of known remedies. While good management and organizational design may reduce accidents in certain systems, they can never prevent them. The causal mechanisms in this case suggest that technical system failures may be more difficult to avoid than even the most pessimistic among us would have believed. The effect of unacknowledged and invisible social forces on information, interpretation, knowledge, and – ultimately- action, are very difficult to identify and control (Vaughan, 1996).

3. METHODOLOGY

3.1 Data Collection

Incident data in the study were obtained from CAB, CAAP and online ICAO journals and reports. Airline data were obtained from the respective airlines who agreed to participate in the research.

3.1.1 Incidents

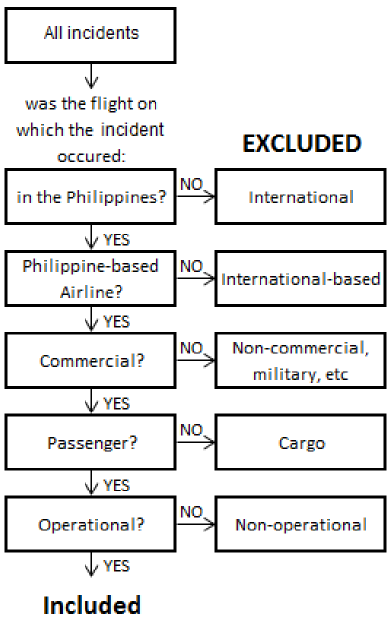

Figure 5. Incident Selection Criteria

Figure 4 was used in selecting the incidents included in the study. These incidents happened in the Philippines, involving Philippine-based airlines, on commercial passenger planes during the flight.

3.1.2 Airline Data

Questionnaires were provided to the participating airlines. The questionnaire included checklist of aircraft equipment, conduct of operations, partnership and alliance and airline financial standing, together with questions regarding aircraft fleet age, fleet composition and airline maturity.

In the aircraft equipment checklist, airlines were expected to check whether the listed devices are present in all, most, few or none of their aircrafts.

For the conduct of operations and financial standing, airlines were expected to check whether the listed safety functions are attained in excellent, good, fair or poor manner.

Under partnerships and alliances, airlines were expected to check whether they have or do not have significant code-shares, technical co-operation and strategic alliances.

3.2 Data Analysis

Incident data were graphed and analyzed to obtain the different incident rates and trends. Equations and lookup tables provided by IAOGP were used in computing for the airline safety scores.

3.2.1 Flight Landing Data

Data provided by CAAP only cover landings from 2001 to 2015. In obtaining the rest of the flight landings data from 1995 to 2015, linear trendline scheme in Microsoft Excel was used. Only the data from 2001 to 2006 were used in obtaining for the trendline since these values exhibit linear increase, providing more realistic data for the previous years, unlike when considering the data from the succeeding years where the number of flight landings exhibit sudden increase.

3.2.2 Rates and Trends

Incident, fatal accident and fatality rates, as well as incident phases and occurrence trends, were computed and graphed using Microsoft Excel.

The data were grouped according to year, from 1995 to 2015. In obtaining for the incident, fatal accident and fatality rates, the corresponding value is multiplied to 1 million and divided by the number of landings.

For the trend with respect to the types of occurrence, data were grouped under abnormal runway contact, runway incursion, controlled flight into terrain, runway excursion, engine failure and fire. While for the phases of operation, data were categorized under landing, take off, descent, cruise and climb.

3.2.3 Airline Safety Score

Using the IAOGP safety assessment mechanism, the airline safety score was computed using the equation below,

$$\boldsymbol{AS = \frac{SF\ x\ (AF+CF)}{1.5}} \qquad (1)$$

where AS = Airline Safety Score
SF = Safety Factor
AF = Airline Factor
CF = Country Factor

The Airline and Country Factors from Equation (1) were the summation of all airline and country factor parameters from the IAOGP lookup tables. Safety factor was computed using Equation (2),

$$\boldsymbol{SF = (1 - 0.2\sqrt{EAR\ per\ 200{,}000\ landings})} \qquad (2)$$

where EAR = Effective Accident Rate

$$\boldsymbol{EAR = (WNA + 1)\ per\ 200{,}000\ landings} \qquad (3)$$

where WNA= Weighted Number of Accidents

The weighted number of accidents is the quantitative measurement on the severity of accidents the airline was involved in, as shown in Equation (4),

$$WNA = (OF1 \times 3.0) + (OF2 \times 2.5) + (OF3 \times 2.0) + (OF4 \times 1.0) + (OF5 \times 0.25) \quad (4)$$

where OF1= Number of fatal accidents with more than 20 fatalities
OF2= Number of fatal accidents with 10-20 fatalities
OF3= Number of fatal accidents with less than 10 fatalities
OF4= Number of accidents with injuries
OF5= Number of incidents with no injuries

4. RESULTS AND DISCUSSION

4.1 Analysis of Incident Rates

Incident data were graphed and analyzed per year in obtaining the annual incident, fatal accident and fatality rates per 1 million landings from 1995 to 2015.

4.1.1 Annual Incident Rate

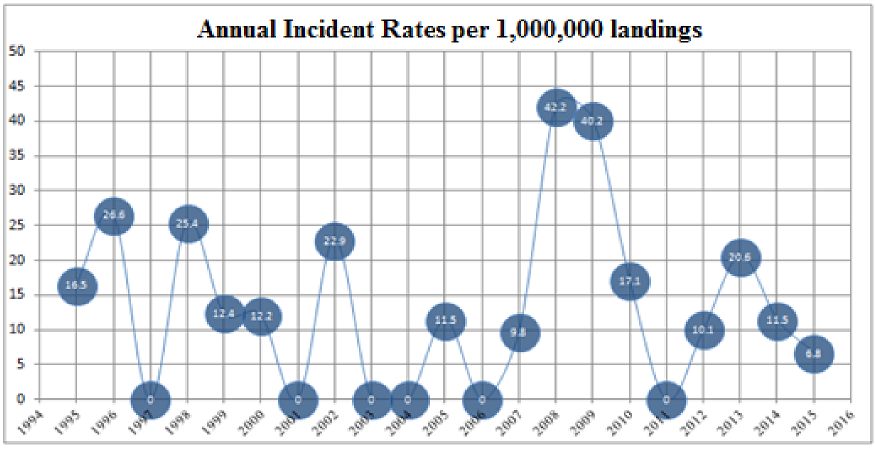

Figure 6. Annual Incident Rates per 1 Million Landings

Figure 6 shows the annual incident rate per 1 million landings, as derived from the data obtained from CAB and CAAP. Since 1995, the highest rates occurred in 2008 and 2009 with more than 40 incidents per 1 million landings. And there are years with no recorded incidents at all. The average rate for the past two decades is 13.61 incidents per 1 million landings.

4.1.1.1 Comparison of Results with Global Average

Table 1. Global Incident Rates per 1 Million Landings

Year	Global Incident Rate (per million landings)	Year	Global Incident Rate (per million landings)
2000	4.6	2008	4.5
2001	3.9	2009	4.0
2002	4.1	2010	4.1
2003	4.6	2011	4.2
2004	3.5	2012	3.2
2005	4.1	2013	2.8
2006	3.8	2014	3.0
2007	4.0	Average	3.9

Comparing the values from Figure 6 and the global incident rates obtained from ICAO shown in Table 1, it can be observed that the Philippines has significantly high incident rates. Considering the data from 2000 to 2014, the average incident rate of Philippines is 13.2 compared to 3.9 average incident rate of the world.

4.1.2 Annual Fatal Accident Rate

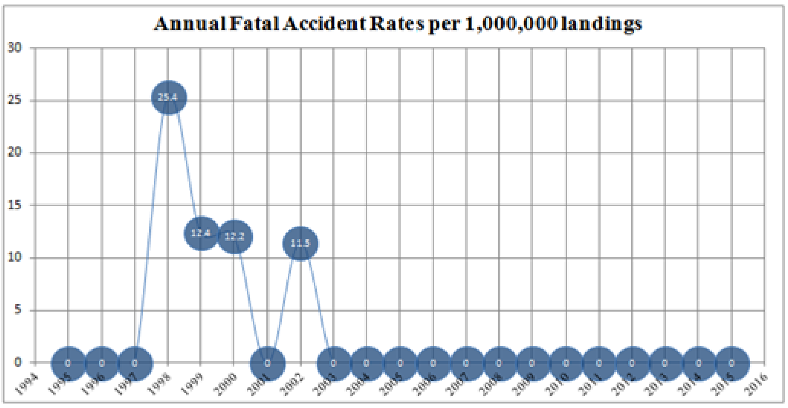

Figure 7. Annual Fatal Accident Rates per 1 Million Landings

Figure 7 corresponds to the annual fatal accident rate per 1 million landings, as derived from the data obtained from CAB and CAAP. Since 1995, the highest rate occurred in 1998 with 25.4 fatal accidents per 1 million landings. There are no fatal accidents in most of the other years. The average rate for the past two decades is 2.93 fatal accidents per 1 million landings.

4.1.2.1 Comparison of Results with Global Average

Table 2. Global Fatal Accident Rates per 1 Million Landings

Year	Global Fatal Accident Rate (per million landings)
2013	0.3
2014	0.2

Comparing the values from Figure 7 and the global fatal accident rates obtained from ICAO shown in Table 2, it can be noted that the Philippines has zero fatal accidents in 2013 and 2014 while the global fatal accident rates are 0.3 and 0.2 for 2013 and 2014, respectively.

4.1.3 Annual Fatality Rate

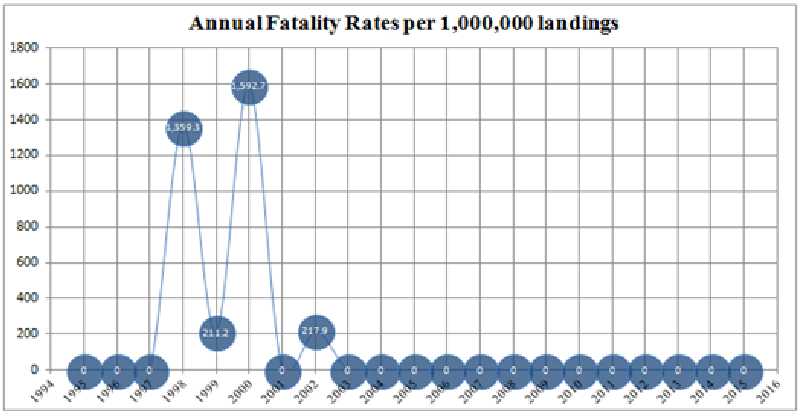

Figure 8. Annual Fatality Rates per 1 Million Landings

Figure 8 pertains to the annual fatality rate per 1 million landings, as derived from the data obtained from CAB and CAAP. Since 1995, the highest rate occurred in 2000 with over 1500 fatalities per 1 million landings. There are no fatal accidents in most of the other years. The average rate for the past two decades is 161.01 fatalities per 1 million landings.

4.1.3.1 Comparison of Results with Global Average

Table 3. Global Fatality Rates per 1 Million Landings

Year	Global Fatality Rate (per million landings)
2013	5.4
2014	27.4

Comparing the values from Figure 8 and the global fatality rates obtained from ICAO shown in Table 3, it can be noted that the Philippines has zero fatal accidents in 2013 and 2014 while the global fatality rates are 5.4 and 27.4 for 2013 and 2014, respectively.

4.2 Analysis of Incident Trends

Incident data were graphed and analyzed in terms of occurrence type and operation phase. Trends were identified from the number of frequency, represented by blue bar, number of fatalities, represented by red bar, and number of injuries data, represented by orange bar.

4.2.1 Types of Occurrence

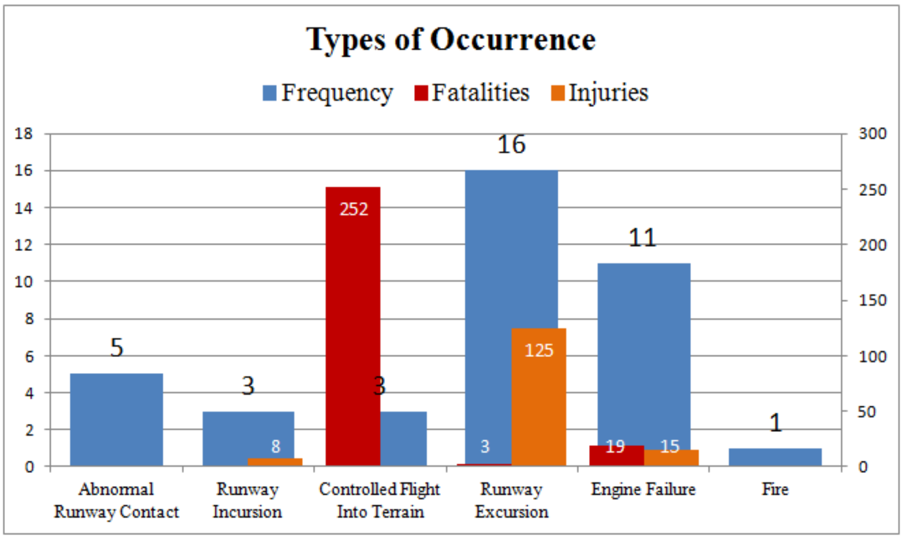

Figure 9. Incident Trend with respect to the Types of Occurrence

Based from the data obtained from CAB and CAAP, Figure 9 shows the frequency, number of fatalities and number of injuries of incidents with respect to the types of occurrence for the period 1995 to 2015. The main cause of incident is runway excursion with 16 times frequency followed by engine failure and abnormal runway contact with 11 and 5 times frequency, respectively. On the other hand, the accident with the most number of fatalities is controlled flight into terrain with 252 deaths.

ICAO defines runway excursion as a veer off or overrun of an aircraft off the runway surface or a situation where an aircraft makes an inappropriate entrance or exit on the runway. Controlled flight into terrain includes all instances where the aircraft was flown into terrain in a controlled manner, regardless of the crew's situational awareness.

4.2.2 Phases of Operation

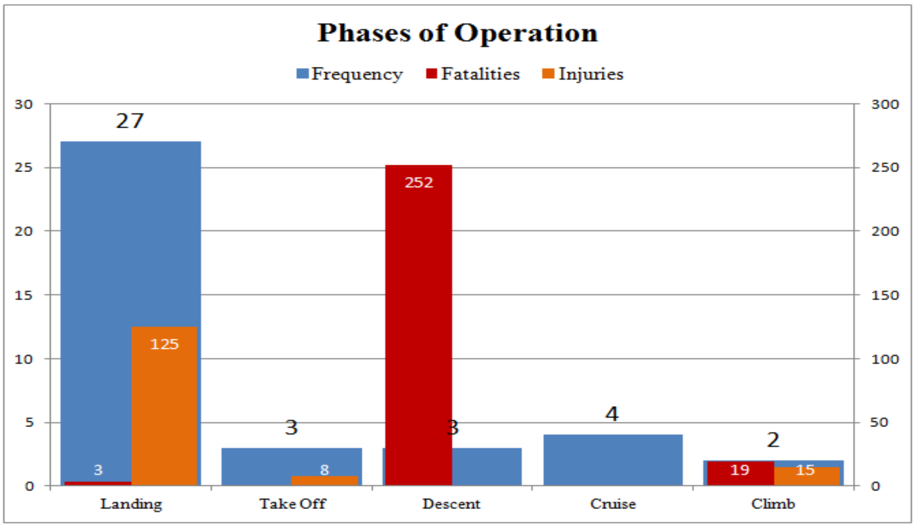

Figure 10. Incident Trend with respect to the Phases of Operation

Based from the data obtained from CAB and CAAP, Figure 10 corresponds to the frequency, number of fatalities and number of injuries of incidents with respect to the phases of operation for the period 1995 to 2015. The most susceptible phase is landing with 27 times frequency followed by cruise, take off and descent. On the other hand, the phase with the most number of fatalities recorded is descent with 252 deaths.

4.3 Airline Safety Assessment

Airline safety assessment scoring of IAOGP ranges from 0 to 10. A score of 10 represents perfect airline safety record and other positive attributes. A score of 0 represents high danger where risk of accident approximates to less than 1 per 4000 flights.

4.3.1 Country Factor Computation

Table 4. Country Factor Parameters and Result

	Score	Multiplier	Cumulative
Regulatory Oversight	1.00	1.50	1.50
National Safety Influence	0.60	0.50	0.30
Air Traffic Environment	1.00	1.25	1.25
Airfield Environment			
a. Terrain	0.10	1.25	0.13
b. Climate	0.50	1.25	0.63
Country Security	0.50	0.50	0.25
		Total	4.05

Country Factor was computed by summing all the parameters shown in Table 4. Philippines obtained a Country Factor of 4.05 out of the maximum possible score of 5.

4.3.2 Airline Factors Computation

Airline Factor is the summation of scores based from aircraft fleet age and equipment, airline fleet composition, conduct of operations, partnerships and alliances, financial standing, maturity and security.

4.3.2.1 Airline A

Table 5. Airline Factor Parameters and Result for Airline A

	Score	Multiplier	Cumulative
Aircraft Fleet Age	1.00	2.00	2.00
Airline Fleet Composition	0.99	1.00	0.99
Aircraft Equipment	1.00	1.50	1.50
Conduct of Operations	1.00	3.00	3.00
Partnerships & Alliances	0.67	1.00	0.67
Airline Financial Standing	1.00	0.50	0.50
Airline Maturity	1.00	0.50	0.50
Airline Security	0.50	0.50	0.25
		Total	9.40

By summing all the parameters shown in Table 5, Airline A obtained an Airline Factor of 9.40 out of the maximum possible score of 10.

4.3.2.2 Airline B

Table 6. Airline Factor Parameters and Result for Airline B

	Score	Multiplier	Cumulative
Aircraft Fleet Age	1.00	2.00	2.00
Airline Fleet Composition	0.97	1.00	0.97
Aircraft Equipment	0.75	1.50	1.13
Conduct of Operations	1.00	3.00	3.00
Partnership & Alliances	0.67	1.00	0.67
Airline Financial Standing	1.00	0.50	0.50
Airline Maturity	1.00	0.50	0.50
Airline Security	0.50	0.50	0.25
		Total	9.01

By summing all the parameters shown in Table 6, Airline B obtained an Airline Factor of 9.01 out of the maximum possible score of 10.

4.3.3 Safety Factors Computation

Safety Factor was computed based from the Weighted Number of Accidents. WNA is a quantitative measurement on the severity of accidents the airline was involved in. The equation also takes into consideration the number of successful flight landings the airline has made since 1995

4.3.3.1 Airline A

Table 7. Weighted Number of Accidents Result for Airline A

	Frequency	Multiplier	Cumulative
OF1	1	3.00	3.00
OF2	0	2.50	0.00
OF3	0	2.00	0.00
OF4	3	1.00	3.00
OF5	7	0.25	1.75
Weighted Number of Accidents			7.75

Airline A obtained a WNA of 7.75 as shown in Table 7. Based from the incident data from CAB and CAAP, the airline has experienced 7 minor incidents, 3 accidents with injuries involved and 1 accident with more than 20 fatalities since 1995.

Table 8. Summary of Parameters for Safety Factor of Airline A

Number of landings since 1995	1,195,840
Effective Accident Rate	1.46
Safety Factor	0.758

The Effective Accident Rate and Safety Factor in Table 8 were computed using Equations (3) and (2), respectively. The computed Safety Factor of Airline A is 0.758 out of the maximum possible score of 1.

4.3.3.2 Airline B

Table 9. Weighted Number of Accidents Result for Airline B

	Frequency	Multiplier	Cumulative
OF1	1	3	3
OF2	0	2.5	0
OF3	0	2	0
OF4	0	1	0
OF5	7	0.25	1.75
Weighted Number of Accidents			4.75

Airline B obtained a WNA of 4.75 as shown in Table 9. Based from the incident data from CAB and CAAP, the airline has experienced 7 minor incidents and 1 accident with more than 20 fatalities since 1995.

Table 10. Summary of Parameters for Safety Factor of Airline B

Number of landings since 1995	1,087,887
Effective Accident Rate	1.06
Safety Factor	0.794

The Effective Accident Rate and Safety Factor in Table 10 were computed using Equations (3) and (2), respectively. The computed Safety Factor of Airline A is 0.794 out of the maximum possible score of 1.

4.3.4 Overall Airline Safety Scores

The overall Airline Safety Score was calculated from the Country, Airline and Safety Factors. These values were all computed previously in sections 4.3.1, 4.3.2 and 4.3.3.

4.3.4.1 Airline A

Using Equation (1), the overall Airline Safety Score of Airline A was computed as 6.799 out of the maximum possible score of 10. Though Airline A has a higher Airline Factor than that of Airline B, the overall Airline Safety Score of Airline A is lower since its Safety Sactor is lower compared to Airline B's.

4.3.4.2 Airline B

Using Equation (1), the overall Airline Safety Score of Airline A was computed as 6.914 out of the maximum possible score of 10. Though Airline B has a lower Airline Factor than that of Airline A, the overall Airline Safety Score of Airline B is higher since its Safety Factor is higher compared to Airline A's.

4.3.5 Comparison of Results with Airlines Abroad

Table 11. Summary of the Overall Safety Scores of International Airlines

Airlines	World Region	Country Factor	Airline Factor	Safety Factor	Overall Airline Safety Score
Airline C	Asia/Pacific	5.00	9.79	0.842	8.302
Airline D	Latin America	2.20	7.44	0.790	5.077
Airline E	Western Europe	5.00	8.99	0.895	8.347
Airline F	Middle East	3.4	8.39	0.866	6.807
Airline G	Eastern Europe	4.03	7.34	0.420	3.184
Airline H	Eastern Europe	3.78	5.92	0.910	5.885
Airline I	Africa	2.53	6.21	0.901	5.250
Airline J	Asia/Pacific	3.55	7.26	0.939	6.767
Airline K	North America	4.25	7.79	0.727	5.835
Airline L	Eastern Europe	3.65	3.05	0.714	3.189

Obtained from IAOGP mechanism report, Table 11 pertains to the overall Safety Scores of international airlines, as well as their corresponding Country, Airline and Safety Factors. Comparing the Country Factor values in Table 11 to that of Philippines' 4.05, it should be noted that Philippines, like other Asia-Pacific countries, has high Country Factor. This is due to the Airfield Climate Score of the country since it only has moderate ranges of temperature and precipitation compared to other countries with year-round desert or arctic clear weather conditions or seasonal extremes of temperature and precipitation.

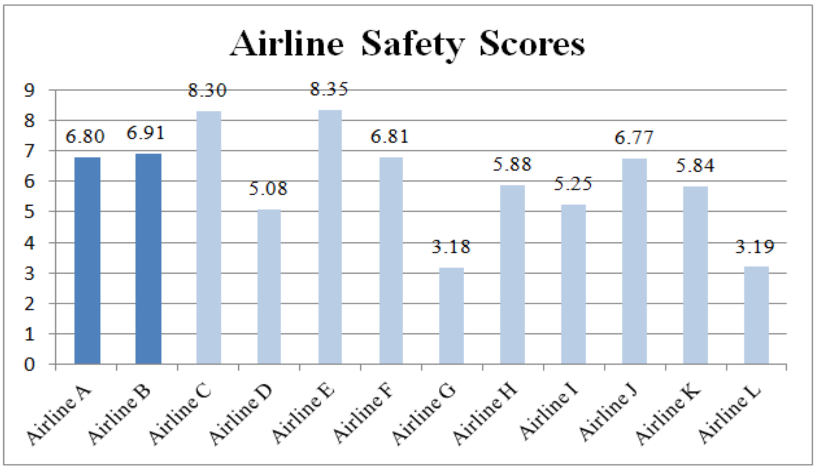

Figure 11. Airline Safety Scores of the Two Philippine-based Airlines Compared with International Airlines

Philippine-based airlines scored above average compared to the Safety Scores of international airlines. But since these international airlines are randomly picked for the assessment, they don't directly represent the entirety of the global average.

4.4 Runway Safety Practices

ICAO has been consistent in its safety reports, stating that runway incursion and excursion are the most frequent incidents worldwide. Below are the safety measures associated with runway incursion and excursion.

4.4.1 Runway Incursion

Both ICAO and Federal Aviation Administration (FAA) have jointly defined a runway incursion as any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

In the country, the Civil Aviation Authority of the Philippines established Runway Safety Office that is responsible for the runway safety initiatives throughout the civil aviation community. Local runway safety teams were also established. They are responsible for improving runway safety data collection, analysis and dissemination and maintaining signage and markings are ICAO-compliant and visible to pilots and drivers. They are also the ones initiating local awareness by developing and distributing runway safety education and training material to controllers, pilots and personnel driving vehicles on the aerodrome.

CAAP is also considering installing technological solutions like Airport Movement Area Safety System that will give visual and aural prompts to tower controllers to respond to situations on the airfield that potentially compromise safety and Moving Map Displays that will show the pilot their own position on the airport surface and can greatly improve runway safety at night and in poor visibility. Other devices that CAAP is looking into are low cost surveillance systems for small and medium sized airports, Runway Status Lights and Final Approach Occupancy Signal.

4.4.2 Runway Excursion

It is generally recommended that airlines consider modifying their approach and landing procedures to incorporate runway safety recommendations. Flight crew should use real-time information to analyze how much runway is required relative to runway available. Runway overrun event data suggest that a number of runway overruns can be avoided if the flight crew has a more thorough understanding of the interrelationship between the landing environment and the potential risks existing that day such as weather, winds, runway conditions, minimum equipment list items, airplane weight, etc.

4.5 International Civil Aviation Organization Safety Audit

Table 12. ICAO's Audit Ratings to Philippines and the Global Average

	Philippines	Global Average
Legislation	90.91	67.57
Organization	81.82	65
Licensing	80.77	72.19
Operations	83.06	66.1
Airworthiness	88.29	74.14
Accident Investigation	44.33	54.29
Air Navigation Services	35.23	57.41
Aerodromes	38.13	56.96

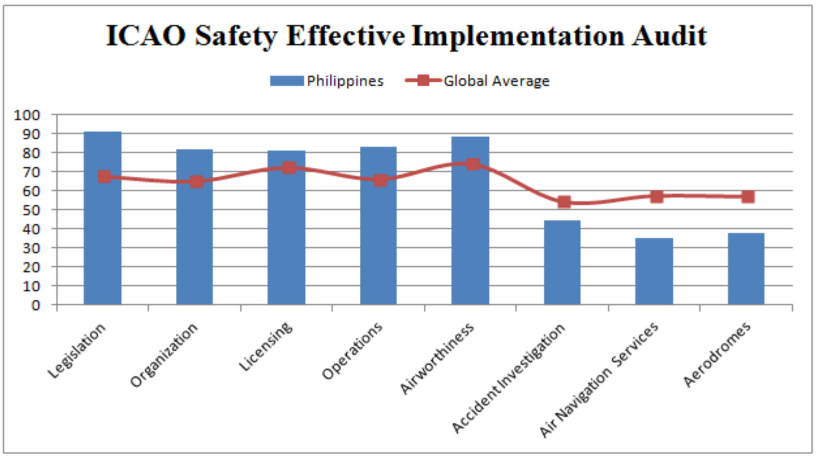

Figure 12. ICAO's Audit Ratings to Philippines and the Global Average

As obtained from ICAO's website, Table 12 and Figure 12 correspond to the effective implementation audit of ICAO to the Philippines. The blue bars pertain to the Philippines' ratings while the red squares are the global average. This rating is based on how satisfactory the country implements the regulations under the eight aviation categories. Under legislation, organization, licensing, operations and airworthiness, the Philippines performs above average while it needs improvement in the areas of accident investigation, air navigation services and aerodromes.

5. CONCLUSIONS

In the recent years, air travel is significantly increasing, thus the risk involved is increasing as well. Since 2000, the average incident rate of Philippines is 13.2, very high compared to the global average of 3.9 of the same time range.

Even though Philippines has a high incident rate, its fatal accident and fatality rates are both zero, as they have been since 2003, while the recent global average for fatal accident and fatality rates are 0.2 and 27.4 per 1 million landings, respectively.

Runway excursion during landing is the most frequent incident but it has relatively low fatality rate, with only 3 fatalities and 125 injuries. Whereas, controlled flight into terrain during descent has low frequency, yet has caused 252 fatalities since 1995, making it the most risky and least survivable type of accident.

Our local airlines have low to moderate risk of being involved in incidents. Airline A scored 6.799 while Airline B is slightly higher with 6.914. Comparing these to international airlines, Philippine-based airlines are above average in terms of overall safety. It can also be noted that Philippines has higher country factor rating since it has the advantage of not having seasonal extremes of temperature and precipitation or year-round desert or arctic weather conditions, making it more conducive to flying.

CAAP has established Runway Safety Office and Runway Safety Teams geared towards improving runway safety and they initiate awareness through trainings and educational materials to controllers, pilots and personnel on the aerodrome. Technological solutions like runway signal lights and surveillance systems are also being looked into.

For the ICAO's safety effective implementation audit ratings, Philippines performs above average under legislation, organization, licensing, operations and airworthiness, but it needs improvement in the areas of accident investigation, air navigation services and aerodromes.

6. RECOMMENDATIONS

In order to further the study, it is recommended that future researches explore deeper on the causes of incidents and take into consideration parameters like model of aircrafts, number of hours flown by the aircraft prior to the accident, number of consecutive hours flown by the pilot, weather condition, etc. With these information, incidents can be broken down and categorized into three main causes: man, machine and environment.

While the study only covers the airline safety scores of the main air carriers in the country, assessment on minor airlines can be included in future researches. This will provide more extensive measurement on the overall safety of domestic scheduled flights in the Philippines.

For the airport runway safety cultures, it is recommended to have actual site visits and recognize how closely aerodromes comply with the CAAP runway safety program. Identifying some local safety practices in preventing runway-related incidents aside from the recommended can be incorporated in the study as well.

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