Factors Affecting the Safety Perception of Commercial Pilot

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Abstract

This research aims to study factors that affect the safety perception of commercial pilots as well as to study the relationship between personal characteristics and level of safety awareness. The samples in this study consisted of 145 commercial pilots. The statistics implemented in the data analysis included frequencies, percentage, means, standard deviation, T-test, One-way ANOVA, and enter multiple regression analysis.

The result of this research indicated that the participants with different personal characteristics such as gender, age, education level, marital status, working position, aircraft fleet, and working experience had no difference in the perception of the safety level. The study also analyzed a multiple regression by using enter method to understand the factors affecting the safety perception of the commercial pilots, including the company's safety policy and the company's operational norms. The company's safety policy provided a positive influence in accordance with the safety perception of the commercial pilots at a significance level of 0.05. Therefore, if the pilots recognize more regarding the company's safety policy, the safety perception will increase significantly. Similarly, the positive company's operational norms also strongly influence the safety perception of the commercial pilots at a significance level of 0.05. Thus, if the pilots concern more about the company's operational norms, the safety perception will increase. For this reason, the airlines should emphasize their safety policy and operational norms to increase the safety perception of the commercial pilots and ensure that their employees, passengers, and all relevant agencies can operate the flight to the highest degree of safety.

Keywords: *Commercial pilot, Perception, Safety*

1. Introduction

In 2018, The Civil Aviation Authority of Thailand (CAAT) began implementing the State Safety Policy; SSP, to determine the intention, direction, vision, and state safety mission to meet the requirements of the standard of the International Civil Aviation Authority as identified by the guidelines and necessity of safety management (Civil Aviation Authority of Thailand, 2019). The State Safety Policy is done in the form of an Announcement of the Civil Aviation Authority through the Minister of Transport as the chairman of the Civil Aviation Authority. It is one of the shortcomings that Thailand must promptly resolve to implement Thailand's safety management plan that includes regulatory, roles and responsibilities, guidelines, and activities of related organizations (CAAT, 2019).

Even though Thailand has received a red flag from International Civil Aviation Organization (ICAO) in the last 10 years, it still has a very high-frequency flight growth rate when considering the circumstances. It is in accordance with the forecast of the International Air Transport Association (IATA). With this progress, Thailand will be among the top ten countries with the highest air travel rate (International Air Transport Association, 2018).

In 2020, the Coronavirus 2019 outbreak severely affected the aviation industry. The Civil Aviation Authority of Thailand announced the closure of Thai airspace to protect against foreign infected people, which inevitably led to a sharp decline in the economy, with airlines not being able to operate overseas (CAAT, 2020). Multiple airlines had to temporarily suspend their operations as well as downsize their employees. Furthermore, some airlines were forced to close down due to massive financial losses. Despite the severe decline in the number of flights in Thailand and all over the world, it does not mean that accidents will not

occur. Statistically, an accident occurs around the world at the rate of 3.02 times per million flights, or a record of 115 times in 2019 (International Civil Aviation Organization (ICAO), 2020).

According to the worldwide statistics provided by ICAO regarding aircraft accidents, from 1950 to 2010, accidents were caused by several factors, which 49% are due to pilot error, 23% are due to aircraft issues, 10% are from weather, 8% are because of terrorism, and the remaining 10% are due to other factors (Kebabjian, 2020). In the same way, the analysis result of the Bureau of Air Safety Investigation (BASI), in Australia concluded that according to BASI databases, the largest proportion of accidents, or 36%, occurred on private or business flights. Factors such as loss of control in flight, collision with terrain, and wiring connection are the most common issues. Furthermore, most of the accident indicates more than one contributing factor, and more than 70% of the accidents are caused by factors related to errors in situation assessments as well as poor decision-making of pilots (Bureau of air safety investigation, 1996).

These findings indicated how the safety perception affects the safety of the flight. For this reason, the researchers are motivated to determine which factor affects the safety perception of the commercial pilots to understand the guidelines, thus increasing the safety perception of the commercial pilots, which for ensuring that the employees, passengers, and all relevant agencies can operate the flight at the highest level of safety.

2. Objective

1) To study the relationship between the personal factors and the safety perception of commercial pilots

2) To study the factors that affect the safety perception of the commercial pilots

3. Material and Methods

Perception is a process in which a person recognizes the feeling and interprets it from the received stimulus through the analysis based on memory, knowledge, combined with existing experiences, and resulting in knowledge as well as understanding and behavioral responses. Even with the same incoming stimulus, it can result in two different perceptions. The fact that humans can recognize things requires plenty of factors and how well people can perceive it depends on the person's perception (Suvanseng, 2000).

Aviation Safety is the state in which the risks associated with aviation activities, related to or directly support the operation of aircraft are reduced and controlled to an acceptable level (ICAO, 2018).

Safety Management System; SMS is a systematic approach to managing safety, which includes the necessary organizational structures, accountability, responsibilities, policies, and procedures. It is determined by (ICAO) to ensure the performance of the aviation industry with effective safety management. The system is designed to continuously improve operations with hazard identification and data analysis methods, as well as safety risk assessment. The system must be the right size for the structure and complexity of the organization to comply with the rules, regulations, and safety targets. ICAO categorizes Safety Management System into four different frameworks and 12 elements, which includes Safety policy and objective (management commitment and responsibility, safety accountabilities, appointment of key safety personnel, coordination of emergency response planning, and SMS documentation), Safety risk management (hazard identification and risk assessment and mitigation), Safety assurance (safety performance monitoring and measurement, the management of change, and continuous improvement of the SMS), and Safety Promotion (Training and education and safety communication) (ICAO, 2018).

Swiss cheese model is the theory that discussed the accidents caused by various combinations of errors. The model is done by comparing the accident prevention to a cheese sheet based on factors such as personal protective equipment to protect against hazards, safety rules, and regulations. A hole or gap on the cheese plate represents a mistake that occurs, and the accident will occur when the protection measures of different systems are neglected on multiple cheese plates. For example, vulnerability is an assumption that the accident is caused by a malfunction of the device or a mistake made by the operational personnel. The swiss cheese model consists of 4 cheese sheets, each of which is unsafe acts, preconditions for unsafe acts, unsafe supervision, and organizational Influences (Reason, 1990).

Domino theory illustrates the sequence or principle of the cause of the accident, by focusing on the behavior or the unsafe acts of the operational personnel. This theory represents the relationship between

behavior, situations, and working environment. The Domino theory can be divided into 5 groups as follows; 1) Social environment and ancestry, 2) Fault of person, 3) Unsafe act and Unsafe Condition, 4) Accident, and 5) Injury (Heinrich, 1931)

SHELL Model was coined by Elwyn Edwards in 1972 to help people to understand the concept of people, machinery, and working environment. In 1987, Frank Hawkins' data was applied to the shell model, which demonstrates the relationship between people and other elements within the aviation industry. The alphabet SHEL stands for S = Software such as manual, rules, and regulations, H = Hardware such as equipment used in operations, E = Environment such as operating environment, and L = Liveware such as the operators (SKYbrary, 2019).

Human Factor Analysis and Classification System; HFACS was invented and developed by Shappell and Wiegmann. This system base itself on the description of human and organizational behavior. The HFACS framework is used as a tool to assist in the investigation process and target training and prevention efforts. Investigators can systematically identify active and latent failures within an organization that culminated in an accident. The goal of HFACS is not to attribute blame, but to understand the underlying causal factors that lead to an accident. Not only the aviation industry applies HFACS theory but also the atomic energy production organization, in which the theory is used to analyze corporate defects and potentially dangerous humans (Shappell & Wiegmenn, 2000).

The Dirty Dozen refers to twelve of the most common human error preconditions, or conditions that can act as precursors, to accidents or incidents. These twelve elements affect people to make mistakes. The Dirty Dozen is a concept developed by Gordon Dupont in 1993. The mentioned 12 elements are detailed as follows.

1) Lack of communication
2) Complacency
3) Lack of Knowledge
4) Distraction
5) Lack of teamwork
6) Fatigue
7) Lack of resources
8) Pressure
9) Lack of assertiveness
10) Stress
11) Lack of awareness
12) Norms (SKYbrary, 2020)

The research on Perception of Employees towards Aviation Security System of Thai Airways International Public Company Limited at Suvarnabhumi International Airport: The objectives of this research are (1) to study the perception level of employees on the aviation security system of Thai Airways International Public Company Limited at Suvarnabhumi International Airport; (2) to study the relationship between personal characteristic factors of employees and the level of employee perception on the security system; (3) to study the relationship between aviation security knowledge of employees and the level of employee perception on the security system; and (4) to recommend improvement of the perception level of employees on the aviation security system of Thai Airways International Public Company Limited at Suvarnabhumi International Airport. This research uses the method of survey research. The population size consisted of 18,602 employees of Thai Airways International Public Company Limited at Suvarnabhumi International Airport. The samples were 400 employees using stratified random sampling. The methods used to collect data are questionnaires while statistical analysis was percentage, mean, standard deviation, One-Way ANOVA, t-test, F-test, Multiple Comparison, and Pearson Chi-Square. The result of the research revealed that (1) the perception level of the employees on the security system is at a good level, (2) personal characteristic factors of the employees in terms of age, position, and year of employment were relative to the employees' perception on the aviation security system with a statistical significance at 0.05, (3) aviation security knowledge of the employees were not related to the perception on the aviation security system of Thai Airways International Public Company Limited at Suvarnabhumi International Airport, and (4) the

recommendation is that the management of Thai Airways International Public Company Limited should provide aviation security training courses for the employees (Kruajaturat & Esichaikul, 2016).

Hypothesis

1) Personal factors, namely gender, age, education level, marital status, working position, aircraft fleet, and working experience, are associated with the safety perception of commercial pilots.

2) The company's safety policy, the company's operational norms, fatigue, communication, education and training, and environmental factors outside the organization affect the safety perception of the commercial pilots.

Research Methodology

The study on the factors affecting the safety perception of commercial pilots is quantitative. The population used in this research was recruited from a commercial airline in Thailand, consisting of 227 pilots. A calculated sample from Taro Yamane's table, at a 95% confidence level and a 5% tolerance level from a calculated formula, had resulted in a total of 145 pilots.

The researcher studied and researched various variables of factors involved in this research's topic ranging from conceptual documents, academic theory, manuals, to both domestic and international research related to factors affecting the safety perception of commercial pilots to create and develop the questionnaire. Furthermore, the researcher followed recommendations from a counselor and 3 experts to consider the validity using the Index of the item–Objective Congruence; IOC. Then, the reliability was confirmed using Cronbach's Alpha Coefficient by conducting a survey on a group of 30 participants. The result demonstrated a 0.88, meaning that the questionnaire was highly reliable (Ursachi et al., 2015). The questionnaire can also be further used to collect data. The data collection will take place between June 2020 to August 2020, which consist of 4 parts as follows:

Part 1: Questions concerning gender, age, education level, marital status, working position, aircraft fleet, and working experience of the commercial pilots.

Part 2: Questions concerning the company's safety policy, the company's operational norms, fatigue, communication, education and training, and environmental factors outside the organization that affect the safety perception of the commercial pilots.

Part 3: Questions concerning the level of safety perception.

Part 4: Open-ended questions to find out other factors that may affect the safety perception of commercial pilots and other recommendations.

Data Analysis

This study was divided into two analytical parts consisting of general analysis and hypothesis analysis. The researcher implemented descriptive statistics, namely, frequency, percentage, mean, standard deviation, and inferential statistics, which consist of a t-test for independent samples One-way Analysis of Variance, ANOVA. Besides, the researcher also examined the relationship between the variables by using Pearson's correlation coefficient analysis and multiple linear regression analysis.

4. Results and Discussion

Part 1 Preliminary analysis of the sample

The majority of the respondents were commercial pilots of a commercial airline. Out of 145 respondents, 130 were male, which is equivalent to 89.66%. 70 respondents or 48.28% were in the age range of 31-40 years. Most of them (117 respondents or 80.69%) had a bachelor's degree. 79 people, or equivalent to 54.48%, were married. 85/117 or 58.62% were first officers. Among them, 107 participants were flying aircraft type A, equivalent to 73.79%. Lastly, their working experience was mostly between 4-10 years, accounting for 62 participants or 42.76%.

Part 2 Analysis results to test the hypothesis

Hypothesis 1: The comparison of safety perception level of the commercial pilots based on gender, age, education level, marital status, working position, aircraft fleet, and working experience had no difference in the safety perception level at a statistically significant level of 0.05.

Hypothesis 2: According to the analysis of multiple regression analysis, the result concluded that the factors affecting the safety perception of the commercial pilots consisted of the company's safety policy and the company's operational norms at a statistically significant level of 0.05.

The conceptual framework of the analysis of 7 variables consisted of 6 independent variables, namely, the company's safety policy, the company's operational norms, fatigue, communication, education and training, and environmental factors outside the organization, and a dependent variable; the safety perception of the commercial pilots. The analysis of the relationship between the variables found that all 6 independent variables were associated with the dependent variable regarding the safety perception at a statistically significant level of 0.05. The independent variables that most associated with the safety perceptions were the company's operational norms (r = 0.710, $p < 0.001$), which showed a positive relationship, followed by the company's safety policy (r = 0.631, $p < 0.001$) that also showed a positive relationship. The least correlated factors was fatigue (r = -0.252, $p = 0.001$), which showed a negative relationship. The finding concluded that the independent variables and dependent variables are well correlated.

Besides, the results of the analysis found that various factors were statistically significantly correlated at the level of 0.05 for every pair. The most highly correlated independent variables were the company's operational norms and communication (r = 0.691, $p < 0.001$) whereas the least correlated independent variables are environmental factors outside the organization and fatigue (r = -0.202, p = 0.007).

As a result, the relationship between independent variables constitutes not more than 0.80. Therefore, this analysis has no problem with multicollinearity (Hair, Black, Babin & Anderson, 2010). Moreover, it is appropriate to continue to analyze the multilateral regression coefficient.

Table 1 Correlation coefficient between variables of factors affecting the safety perception of commercial pilots and the level of safety perception of commercial pilots.

independent variables	1	2	3	4	5	6	7
1. Company's safety policy	1.00						
2. Company's operational norms	.631*	1.00					
3. Fatigue	.710*	.639*	1.00				
4. Communication	-.252*	-.262*	-.328*	1.00			
5. Education and training	.478*	.541*	.691*	-.316*	1.00		
6. Environmental factors outside the organization	.560*	.518*	.667*	-.331*	.680*	1.00	
	.369*	.416*	.409*	-.202*	.390*	.572*	1.00

Notes: $p < 0.05$

Multiple linear regression coefficients analysis using all independent variables to predict simultaneously (Enter method) found that the 6 factors, which include company's safety policy, company's operational norms, fatigue, communication, education and training, and environmental factors outside the organization, were associated with the variable related to the safety perception of the commercial pilots (R = 0.757) and can predict the safety perception at 57.40% with $R^2 = .574$ (adjusted $R^2 = .550$) The six factors are considered to predict a level of moderate to high safety perception and statistically significant at the level of 0.05 (F = 30.93, $p < 0.001$). The analysis results are shown in Table 2.

Table 2 The result of multiple regression analysis

R	R^2	adjusted R^2	SE	F	p
.757	.574	.555	0.35	30.93*	.000

Notes: $p < 0.05$

According to the analysis, at least one independent variable predicts the variable accordingly. Therefore, it is necessary to determine which independent variable influences the variable accordingly. The

consideration of the multiple linear regression coefficients of factors affecting the safety perception of commercial pilots found that two factors affect the safety perception of commercial pilots, which the explanations are as follows:

1) The company's safety policy has a positive influence on the safety perception of commercial pilots at the statistically significant level of 0.05. ($\beta = 0.300$, $p < 0.001$), meaning that, if the pilots recognize more about the company's safety policy, the safety perception will be increased.

2) The company's operational norms have a positive influence on the safety perception of commercial pilots at the statistically significant level of 0.05. ($\beta = 0.512$, $p < 0.001$), meaning that, if the pilots recognize more about the company's operational norms, the safety perception will be increased.

Table 3 The influence coefficient of independent variables on dependent variables

independent variable	b	SE	β	t	*p*
a (Constants variables)	-0.41	0.46		-0.90	.372
Company's safety policy	0.42	0.11	.300	4.00*	.000
Company's operational norms	0.59	0.10	.512	5.69*	.000
Fatigue	0.00	0.04	.002	0.03	.974
Communication	-0.13	0.07	-.151	-1.78	.078
Education and training	0.20	0.11	.167	1.85	.066
Environmental factors outside the organization	0.00	0.07	-.001	-0.01	.989

Notes: $p < 0.05$

5. Conclusion

Regarding the research on the factors affecting the safety perception of the commercial pilots, below are the discussion of the results by sections.

The respondents' personal information: After comparing the level of the safety perception of commercial pilots as classified by their personal information, the result concluded that the pilots with different personal characteristics such as gender, age, education level, marital status, working position, aircraft fleet, and working experience had no difference in the safety perception level, which corresponds to the research on Safety awareness. Furthermore, the effect on the safety behavior in work of operation workers of Polyfoam Group Co., Ltd. (Sutarrom & Nurittamont, 2018) mentioned that people with different demographic characteristics such as gender, age, education level, work experience, received safety training, and accidents in work have no difference in the safety behavior of the employees at the operating level.

The company's safety policy: The results of the analysis demonstrated that the company's safety policy affected the safety perception of the commercial pilots. Overall, the pilots had the highest level of perception of the company's safety policy, which corresponds with the regulations of The Civil Aviation Authority of Thailand. Moreover, they prioritized the safety policy as required for all airlines to have a safety policy to ensure that everyone within the organization is informed. CAAT also established a state safety policy to determine the intention, direction, vision, and state safety mission. It identifies important and necessary approaches to safety management that are clearly reflected in practice (Civil Aviation Authority of Thailand, 2019). Besides, the result also corresponds to the research on the Implementation of Occupational Safety and Environment Policy of Kanemitsu Pulley Co., Ltd (Santimit & Wongtong, 2018), as described in the result section. The relationship of the factors involved in implementing the policy concluded that the clarity of the policy objectives positively related to the implementation of the policy as well as the success of achieving the policy implementation objectives. It can be determined that the employees will undergo implementation and follow the organization's safety policy.

Company's operational norms: The results of the analysis showed that the company's operational norms affected the safety perception of commercial pilots. Overall, the pilots had the highest level of perception of the company's operational norms, which corresponds to the Theory of Reasoned Action (TRA) by Icek Ajzen in 1985 that was developed from the Theory of Planned Behavior (TPB). The theory can be described as a Subjective Norm and is one of the factors that affect human behavior. The result also

corresponds to the research on the Perception of the Organizational Climate and Organizational Citizenship Behavior of the Department of Human Resources and Compliance, Thai Airways International Public Co., Ltd (Srisirarak & Pasunon, 2016). The findings were described as an influential organizational climate with a positive influence on the organization's good membership behavior. It, in turn, will support the organization to achieve its goals as well as maintain a good working environment.

The researchers found that the factors that affect the safety perception of the commercial pilots were the company's safety policy and the company's operational norms. Further researches are recommened as follows.

1) Study the safety perceptions of other types of pilots, such as military pilots, personal pilots, or helicopter pilots. The different types of pilots may have different corporate cultures and different practices.

2) Study the guidelines to promote the safety policy that should be taken as a model for the organization.

3) Study the guidelines to help establish the norms for good flight practice.

Lastly, the factors affecting safety perceptions with the sample being commercial pilots of one airline found in this study were from the samples of only one airline, the results may not cover every commercial pilot of other airlines due to their different corporate cultures and different practices.

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