國立成功大學

交通管理科學系

博士論文

航空公司空勤組員安全行為影響因子之研究

Investigating Factors Affecting Air Crew's Safety Behavior

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中華民國一百零二年十二月

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本論文業經審查及口試合格特此證明

論文考試委員：

指導教授：

系(所)主管：

中　華　民　國　102　年　12　月　23　日

摘要

空勤組員安全行為表現對航空公司的飛安紀錄影響甚鉅。因人類行為受到個體、團隊及組織之綜合影響，是以本論文建構整合組織、團隊、個人因素之模型，運用結構方程模式分析方法，探討有助提升空勤組員安全行為之可能因素。以文獻回顧及空勤組員工作特性為理論與實務基礎，針對台籍駕駛艙和客艙組員分別進行研究。機師及空服員之個人認知為實證資料來源，選擇航空公司「安全管理系統」運作現況作為組織層面前因，團隊前因則探討機隊經理德行領導與空服管理部門經理仁慈領導分別對於機師與空服員安全行為之提升作用。個人影響變項中，機師以「自我效能」、空服員以「核心自我評量」作為代表變項。此外，研究架構納入機師安全動機與空服員向上安全溝通做為兩概念模型之中介變項。

經由實證資料分析得知，安全管理系統及自我效能對於機師安全行為具有顯著正向之直接和間接效果，而機隊經理之德行領導則藉由安全動機間接正向影響機師安全行為。安全管理系統對於空服員之安全行為亦具有顯著之正向直接影響，而管理部門經理之仁慈領導除顯著影響空服員之安全參與外，另經由向上安全溝通之中介效果，間接正向影響其安全遵守行為。空服員核心自我評量正向直接影響安全遵守行為及間接影響安全參與行為。三項前因證實對於空勤組員之安全行為具有顯著影響效果，而機師安全動機和空服員向上安全溝通之中介效果亦獲得支持。

研究結果對於組織安全行為相關理論及航空業人力資源實務運作皆有所益。建議國籍航空公司用心投入安全管理系統之施行，鼓勵空勤管理單位主管奉行德行領導及仁慈領導，甄選較高自我效能之機師和核心自我評量之空服員並施以持續訓練，藉此激發機師安全動機與鼓勵空服員向上安全溝通，以期全面提升空勤組員之安全行為表現。

關鍵詞：空勤組員、安全行為、安全管理系統、德行領導、仁慈領導、自我效能、核心自我評量、安全動機、向上安全溝通

ABSTRACT

Aircrew plays an essential role in airlines' safety record. The current dissertation aims at developing two models to explore the relationships among the selected organizational, group, individual aspects' factors and aircrew's safety behaviors. Based on the literature review and context of aircrew's specific job characteristics, pilots' perceptions of their airlines Safety Management System (SMS) practice, fleet managers' morality leadership and self-efficacy are chosen as antecedents, while safety motivation is served as a mediator to link to pilots' safety behavior. As for cabin crew, flight attendants' perceptions of SMS practice, department managers' benevolent leadership and core self-evaluations are the targeted indicators in the conceptual model, while upward safety communication employed as the mediator.

The results analyzed by applying Structural Equation Modeling (SEM) technique indicate that all selected antecedents have significantly and positively direct or indirect effects on aircrew's safety behaviors. The mediating effects of pilots' safety motivation and flight attendants' upward safety communication have also been confirmed. The findings contribute to enhancing both safety behavior related literature and airlines human resource management in practice.

Airlines are recommended to continuously improve SMS practice, encouraging managers to perform morality and benevolent leadership, applying self-efficacy and core self-evaluations as the criteria to recruit appropriate pilot and flight attendant candidates to enhance pilots' safety motivation and flight attendants' upward safety communication. Aircrew's safety behaviors are expected to be improved through the aforementioned implementations.

Keywords：Aircrew; Safety behavior; Safety Management System; Morality leadership; Benevolent leadership; Self-efficacy; Core self-evaluations; Safety motivation; Upward safety communication

誌謝

四年又三個月，約莫一千五百個日子，如同這一百七十餘頁的篇幅，每一個字的背後，是一步一腳印的緩慢摸索：學習、前進、挫折、再學習、再前進、再挫折、再學習、再……， Chapter 5 的最後一個句號，不是終點，是另一段旅程的起點。

再次啟程前，對於人生這一段不尋常的四年時光，必須正心誠意地記錄下我的感恩和感動。年逾九旬的父親，您恆常是我風雨無阻、越挫越勇的精神支柱。十年前辭世後常伴菩薩左右的母親，您永遠是我心底最最溫暖柔軟的依歸。指導教授陳勁甫博士，我知道無論自己如何努力，都難望您項背，慶幸自己能夠入您門下，讓我的學術生涯，永遠會有值得努力的目標。張有恆院長的傳道授業，在在於課堂講授和論文口試中，指引迷津。蔡東峻教授的謙沖為懷，我當習之行之。呂錦山教授，雖然不是您的嫡傳弟子，但您所給予的關懷，我絕不或忘。林豪傑教授的細心提點使我獲益良多。更萬分感恩顏進儒教授、溫傑華教授和鍾易詩教授舟車勞頓南下提供寶貴的評述和建議，讓我有機會更加充實豐富博論的質量。

選擇於已屆不惑之年時挑戰博士學位，若非有幸加入 Lab 213，得雅玲、佩君兩位「學姊妹妹」的細心教導研究工具，這條學習之路，怕是要坎坷萬分的。還有許多不吝付出協助、彼此關懷分享的學長姊、同學和學弟妹們：學鵬大哥、繼昌、珮琪、偉銘、清濱、林芝、治平、思瑜、淑賢、壽山、昭堂、松輝和 Lab 213 所有親愛的小朋友們，每一個名字，都是我心底深深刻印的美麗痕跡。

四年不長，因為再多的喜怒哀樂，回首時便只是一眼瞬間；但這博班四年多的學習過程卻不能說短，如同論文投稿的過程，所有的蟄伏醞釀累積等待，傾所有心力可能只換來一次又一次的失敗經驗，而失敗的心路歷程，是漫長的。然而我是如此幸運地被引領著，即使走在荊棘滿佈的道路，表皮一些擦傷實在不算甚麼，能夠學會謙卑、心存感恩，最終明白只要方向正確，抵達彼岸不過遲早罷了。我此身此生，既是為了圓滿因緣而存在，所有立下的善願定當永誌不忘，盡其在我。願與我最愛的家人和朋友們共享，謝謝你們成就我的一切，我的人生因為你們而無限美好。

陳淑娟 謹誌 102.12.23.

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CHAPTER 1 INTRODUCTION

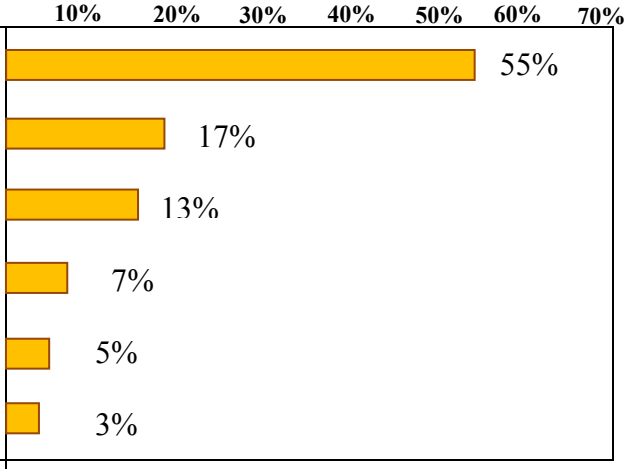
1.1 RESEARCH BACKGROUND AND MOTIVATION

Safety has always been a critical consideration in air transport, since safety record not only identifies airlines professional performance, but is crucial to the establishment of reputation and corporate image. However, while the reliability of machines and computers has been dramatically increased over the years, the reliability of human beings and safety systems has not made progress at the same pace. As a consequence, human error and systemic defects have become the major causes of most aviation accidents (Liou et al., 2008).

In the recent decade, a complementary approach to human error targets on the human factors in work accidents, which takes account of the inevitability of human error and searches for contextualize behavior to gain a deeper understanding of the related issues, based on the appreciations of individual differences (Fogarty and Shaw, 2010). Individuals' behaviors are formed by many factors, stemming from one's knowledge and value base as well as from group norm and organizational culture (Bill, 2003). How human beings perceive themselves and the interaction with job related miscellaneous issues may thus all have direct effects on people's organizational behavior. While employees act as part of a group within an organization, their behavior may be taken as the response to the expectations of the organization, or the results of the combination of personal characters and perceptions of external influences. Among which it is the task of management to integrate the individual and organization, and provide a working environment where it permits the satisfaction of individual needs, also attains the organizational goals (Chaneta, 2010).

It is well-known that airlines are composed of a variety of professional crews. Among the diverse crews working for the airline industry, aircrew, which consists of flight crew (namely, pilots) and cabin crew (namely, flight attendants), receives wide attention and plays an essential role regarding the performance of airlines' safety record. Aircrew members are trained to carry on the assigned duties and provide safe air trips for passengers. Although the diverse job characteristics require respective standards and procedures for the cockpit and cabin operations, only working together on board by pilots and flight attendants may guarantee a safe and smooth flight.

Pilots' safety behavior is prevalently regarded as an important determinant of airlines' safety performance, since it has been implicated as a possible cause of many air accidents (Wells, 1997). In Taiwan, for instance, the Aviation Safety Council (ASC) reported that personnel were cited as a cause or factor in 69.7% of accidents within the 10-year period between 2002 and 2011, among which pilots accounted for 51.5% of the causes/factors (ASC, 2012). The statistical data worldwide reveal the similar situation. During the period of 1959-2003, flight crew was listed as the prevalent primary cause factor in the commercial airline jet fleet (Boeing company, 2004). Taking a 10-year statistical data provided by Boeing company being an example, as shown in Figure 1.1, flight crew was responsible for 55% of worldwide hull loss accidents from 1996 through 2005 (Boeing company, 2006). With the statistical data revealing how critical pilots are to the safety performance of the airline industry, it is crucial to identify the factors that may motivate pilots to take more initiative with regard to safety behavior.



Flight Crew	**74**
Airplane	**23**
Weather	**17**
Misc./ Other	**10**
Maintenance	**6**
Airport/Air Traffic Control	**4**
Total with known causes	**134**
Unknown or awaiting reports	**49**
Total	**183**

Figure 1.1 Hull Loss Accidents- Worldwide Commercial Jet Fleet 1996 - 2005
Resource: Boeing Company (2006)

As for cabin crew, behind the stereotypical image of the eye-catching smile on airlines' advertisements, flight attendants are primarily trained to practice cabin safety policies and guard safety on board. In most Asian countries, including Taiwan, cabin crew is widely seen as service workers and salespersons (Liang and Hsieh, 2005). Their professionalism in implementing cabin safety policies and ensuring safety on board tend to be underestimated. However, the primary job of the cabin crew is to ensure that all safety regulations are followed during flights (Kao et al., 2009). Although this safety responsibility outweighs other cabin duties, such as serving drinks and meals, only recently have issues related to cabin crew safety behavior and safety role begun to receive research attention (Rhoden et al., 2008; Simpson et al., 2004). While the duties and functions assigned to flight attendants in the interests of cabin safety are well established across the aviation industry, how cabin crew perceives their own safety related behavior and what the potential antecedents which may be attributed to it are yet with limited discussion. Given

the paramount importance of safety performance, a deeper understanding of safety behaviors of cabin crew and their affecting factors is necessary.

Traditionally, safety behavior is commonly viewed as a training-oriented behavior. There are standards and procedures to be followed up. Nevertheless, safety behavior can be also enhanced through the impact of related system and personnel, as observed in other organizational behaviors. In the recent decade, researchers have applied organizational citizenship behavior concepts to study safety behavior and term it as safety citizenship (e.g. Hofmann et al., 2003; Fugas et al., 2012). Among the conceptual models established in the related research, safety climate (indicating organizational or group aspect's factor), leadership (indicating organizational or group aspects' factor) and personal attitude and motivation (indicating individual aspect factor) are commonly adopted as the critical determinants of employees' safety behavior. Reviewing a range of themes developing from safety climate theory since the landmark paper published by Zohar (1980), a significant stream of research focuses on variables exerting influences on safety outcomes, with variables classified at either the organizational, group or individual levels (Fogarty and Shaw, 2010). This attempt addresses the similar concept which identifies that from the perspective of organizational behavior, antecedents lead to employee behavior can be categorized into three aspects, i.e., organization, group and individual (Robbins, 2001).

It is noticed that previous research on affecting factors of safety behavior has by and large focused on either organizational, group or individual aspects analyses, respectively. For example, the relationship between organizational safety climate and individual safety behavior has been confirmed by sufficient studies (e.g. Cooper and Phillips, 2004; Johnson, 2007). Leadership styles performed by group leaders, on the other hand, demonstrated diverse influences on subordinates. For instance, Barling et al. (2002) has indicated that

safety specific transformational leadership significantly affects occupational safety. As for individual-aspect factors, personality and attitude have often been related to employees' unsafe behavior (Hunter, 2005; Musson et al., 2004). Despite the extensive research linking various antecedents predicting safety behaviors, few studies examined indicators accounting for organizational, group and individual factors in one conceptual model. To develop an integrated model which simultaneously explores the possible influences of multi-aspects' factors, namely organizational, group and individual, is considered to bridge the research gap and enhance the present literature of safety behavior research.

To understand how human factors account for major aviation accidents, it is critical to look at the organization that people work in and management that they work under (Liou et al., 2008). Taking an airline company as an example, from the perspective of the organization, all parts of the business should be addressed and all employees are subject to work together toward the common goals. The execution of policies must follow the top-down principle and success relies greatly on all employees identifying the shared vision and individual critical role. In addition to addressing the entire organization as one team, in operation, airlines are composed of a variety of professional crews and distinctive departmental subcultures and professional characteristics apparently play important roles in the differences among individuals (Chen and Chen, 2011). Thus it is necessary to identify the potential factors which may influence employees' safety behavior from the group aspect point of view to reflect the diverse subcultures and characteristics of each department.

Furthermore, individuals' perceptions of personal values, beliefs, characters or competences all possibly have impact on their safety behavior and performance. For example, pilots are obligated to manage flight operation and their self-beliefs certainly

affect how they may react under emergency situation. As for cabin crew members, on average one flight attendant has to serve 15 to 20 passengers on board an aircraft (Chen and Chen, 2012b). Being the first line operator, dealing with irregular work schedules, long hours, and difficult passengers all lead to work-related stress and psychological well-being problems (Gunnarsdottir et al., 2006), the emotional stability thus is definitely critical to flight attendants' job performance.

In the organizational aspect, instead of applying the indicators prevalently used in the safety research, e.g., safety climate or safety culture, the current study employs aircrew's perceived practice of airlines' Safety Management System (SMS) as the predictor, due to the airline industry relies on the implementation of Safety Management System (SMS) to integrate safety policies and augment safety performance at both organizational and individual levels in the recent decade (Chen and Chen, 2012a). Meanwhile, an SMS program embodies airlines safety culture, representing safety as the core value to airline operation and focusing on promoting safety as the universal value to every individual. However, though the International Civil Aviation Organization (ICAO) has mandated airlines worldwide to implement SMS since 1th, January 2009 (Maurino, 2007), to date there has been limited empirical evidence to support the positive relationship between the practice of an SMS and airlines safety performance or aircrew's safety behavior. Since aircrew members work for the same airlines must share the same vision of performing SMS, the perception of their airlines SMS practice is regarded the appropriate organizational-aspect factor to investigate the relationship between it and aircrew's safety behaviors.

As for the indicator representing the group aspect, research to date proposes that leadership has a powerful effect on employee work attitudes and behaviors (Yukl, 2002).

The theory of social exchange (Gouldner, 1960) has also been applied to observe the relationship between leaders and subordinates since earlier studies on leadership style and workplace safety focused on the role of relationship-oriented leadership like managerial concern for subordinate' well-being (Dunbar, 1975). Empirical studies have found that high levels of leader-member exchange (LMX) contribute to better safety performance (Michael et al., 2006). Considering the cultural background of the targeted research populations, morality and benevolent leadership styles (Cheng et al., 2000), which are recognized as the distinct dimensions representing paternalistic leadership and congruous with the principle of LMX, are thus applied in the current study. Fleet managers' morality leadership and department managers' benevolent leadership are used to examine the possible impact on flight and cabin crews' safety behaviors, respectively. Paternalistic leadership reflects a relationship in which subordinates willingly reciprocate the care and protection of paternal authority by showing conformity in the non-western society (Aycan et al., 2000; Pellegrini and Scandura, 2006). Since the present paper examines the aircrews working for five Taiwanese international airlines, which are regarded as the international organizations embedded in Chinese culture, it is believed that this study's examination of how morality and benevolent leadership styles may impact aircrew's safety behaviors can add to the literature by extending current understanding of this and related topics.

Meanwhile, personal attributes, such as personality traits and attitude, have also been identified as essential antecedents with regard to employees' unsafe behaviors in the previous studies (Ji et al., 2011). Based on the appreciations of the job characteristics of aircrew by author's field observation and reviewing specific job description handouts, the current paper adopts pilots' perspective of self-efficacy as the individual aspect's indicator, while the core self-evaluations (CSE) assessment is employed as the individual factor for cabin crew. Studies reveal that people with low self-efficacy tend to become unreliable and

unpredictable when engaging in a task (Baudura, 1997). With the tremendous responsibilities taken by flight crew, it is expected that highly self-efficacious pilots may better confront the challenges they meet at work and exert more effort to improve their abilities. Similarly, people with high core self-evaluations are assumed to have positive self-identification and achieve better performance (Erez and Judge, 2001; Judge and Hurst, 2007). Working in the sky, cabin crew is obligated to consistently act with multi-function and emotional stability. It is expected that flight attendants with high CSE are more self-motivated to conduct designated tasks, including safety behavior.

In addition, to further extend the understanding of the related psychological path, pilots' safety motivation has been used as the mediating variable between the selected factors and pilots' safety behavior. Campbell et al. (1996) propose that motivation is one of the determinants of individual performance. Griffin and Neal (2000) also argue that safety performance is determined by the motivation of individuals to perform the behavior. With safety motivation served as the mediator, the direct and indirect effects of the selected multi-antecedents have on pilots' safety behavior may be simultaneously examined.

As for cabin crew, since they work at the first line and serve as the liaison between cockpit, cabin and ground, flight attendants possess abundant opportunities to learn not only from the company's training programs, but also interacting with passengers and other professional crew members, such as pilots and maintenances. Communication has thus been long recognized to be essential to well perform the cabin duties. Smith et al. (1978) has indicated that open communication and frequent interactions between employees and managers are important determinants to lead to low accident rates. Since the positive associations between upward safety communication and various indicators of safety performance are observed in other occupations by the previous research (Bentley and

Haslam, 2001; Mearns et al., 2003), this paper also examines how cabin crew assesses their attitude toward upward safety communication, the linkage between it and selected predictors, and its consequences.

Airlines operation is enormously costly. As being a technique, capital and labor intensive industry, safety has no doubt to be the endless and ultimate approach for airlines operation. It will be greatly beneficial for airlines to appreciate how to enhance aircrew's safety behaviors within the existing organizational context without much extra expense. The current research thus applies multi-antecedents, which represent organization, group and individual aspects, to explore whether they may enhance aircrew's safety behaviors.

1.2 RESEARCH OBJECTIVE

The primary objective of this study is to examine how selected multi-predictors may enhance pilots and flight attendants safety behaviors, based on their own perspectives. According to the aforementioned study background and motivation, the current research targets on aircrews who work for five Taiwanese international airlines and aims to achieve the following purposes:

1. Explore the effects of airlines Safety Management System practice, fleet managers' morality leadership and pilots' self-efficacy have on flight crew's safety behaviors.
2. Explore the effects of airlines Safety Management System practice, department managers' benevolent leadership and flight attendants core self-evaluations have on cabin crew's safety behaviors.
3. Propose and empirically test the two conceptual models to simultaneously link multi-factors, mediators and aircrew's safety behaviors.

4. Propose recommendations for enhancing aircrew's safety behaviors based on the research findings.
5. Extend the understanding of the related topics by contributing the empirical results to the current literature.

1.3 RESEARCH SCOPE

This research targets at exploring the potential multi-factors which may influence aircrew's safety behaviors. Due to the limitations of time and data resource, the study populations only focus on flight crew and local cabin crew members who work for five Taiwanese international airlines. The results are mainly illustrated by analyzing the quantitative data collected from the self-administrated questionnaires filled out by Taiwanese pilots and flight attendants working for the targeted airlines. Since the empirical results are based on individual perceptions of the selected attributes, the comparison among different airlines will not be conducted.

1.4 RESEARCH PROCESS

The current study intends to develop integrated models linking multi-factors and aircrew's safety behaviors, with safety motivation and upward safety communication serving as the mediators respectively. After illustrating the research background and motivation, the research population and scope are identified and clear objectives are presented. To better understand each construct and the linkages between the selected variables, a comprehensive review is conducted next. The two conceptual models are developed based on reviewing relevant literature and field observation. To verify the

proposed models, appropriate questionnaires are designed, distributed and collected for data analyses. Finally, the discussion and implication of the research results are presented. Figure 1.2 shows the flow chart to summarize the research process, which identifies the contents in each step.

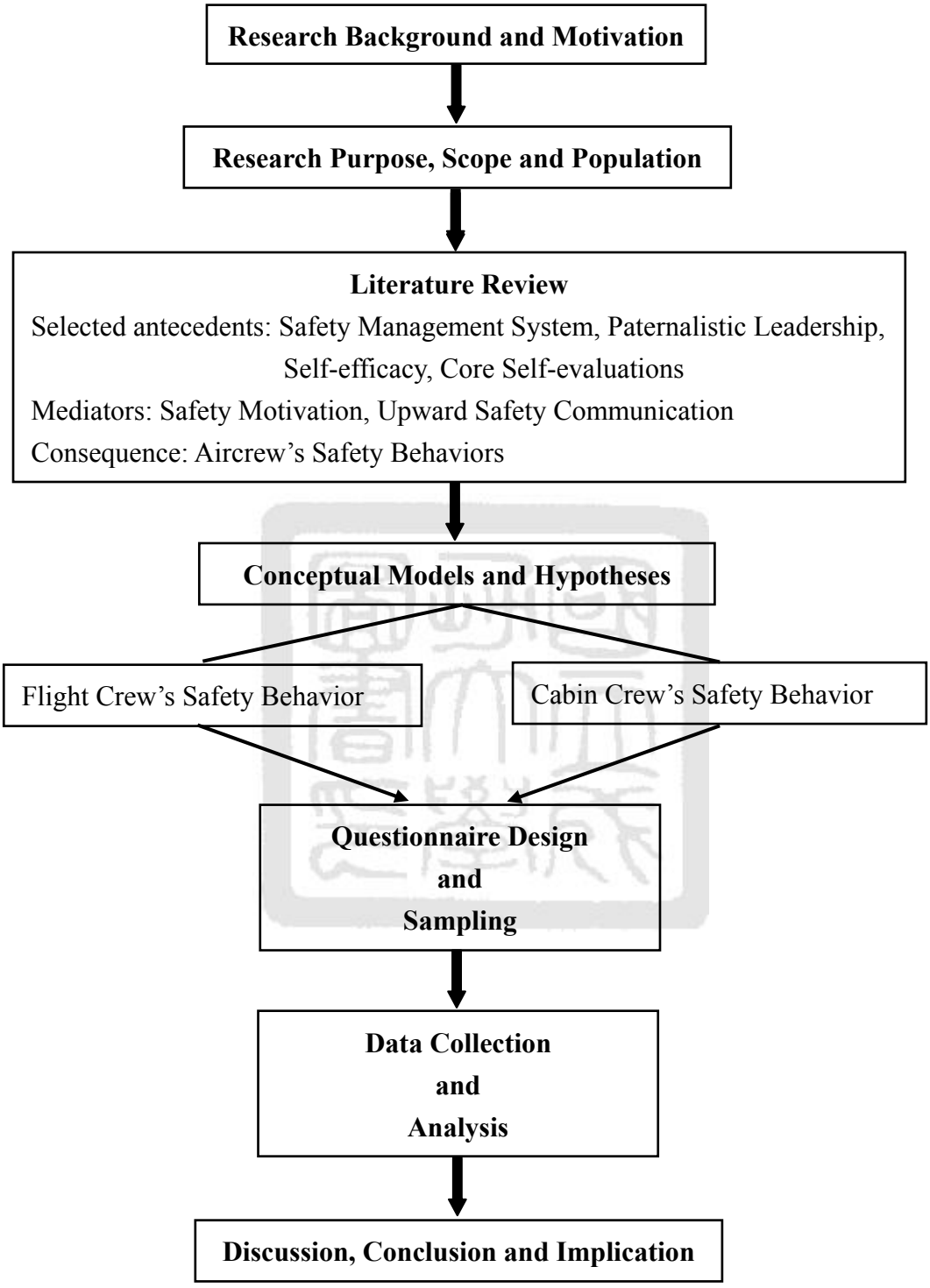


Figure 1.2 Research Process Flow Chart

1.5 RESEARCH STRUCTURE

The current study is organized into five chapters. Chapter one starts with the illustration of research background, motivation, purposes and scope. Chapter two reviews the existing literature which relates to and summarizes the research concepts. Chapter three addresses the research design and methodology used in the study. The conceptual models are developed to propose the hypotheses and lead to the survey questionnaire design. After distributing and collecting the questionnaires, the survey data will be analyzed by multiple statistical techniques. The results and discussion will be presented in chapter four. The final stage is to compose the conclusion and implication sections of the dissertation. Based on the study findings, the research contributions, empirical implications, limitations and directions for future research are discussed and provided in chapter five.

CHAPTER 2 LITERATURE REVIEW

This chapter reviews the literature related to the focal variables in the conceptual models to provide the premise for the current research. Since cockpit crew and cabin crew members share different work characteristics and job responsibilities, the diverse variables used in the two respective models (i.e. cockpit crew safety behavior model and cabin crew safety behavior model), are selected based on the results of reviewing related literature, fieldwork observation and consulting aircrew members. The selection of variables must conform to the following criteria：(1) It has to be closely related to the aircrew's contextualized job characteristics. (2) It has been supported to be capable of enhancing employees' organizational behavior in the previous research.

To comprehensively appreciate what possible factors may lead to aircrew's safety behaviors, antecedents representing organization, group and individual aspects and mediators have been applied to develop two conceptual models linking to flight and cabin crews' safety behavior, respectively. The formulation of the conceptual models are extended from the framework of Stimuli-Organic-Response (S-O-R) model, which basically claims that different stimuli may influence the emotional state of a person (identified as organic in the S-O-R model), consequently leading to a response (Mehrabian and Russell, 1974). The paradigm of the S-O-R model was developed by sociologists to observe the individual's behavioral change, and later has been adopted by economists to study the effects of external and internal stimuli on the actions of companies and consumers' purchasing behavior (Chang et al., 2013; Mattila and Wirtz, 2008). As it is widely recognized for the organizational behavior research to categorize the potential indicators into organization, group and individual aspects, the chosen organizational and group aspects' factors (namely, airline SMS practice, fleet manager's morality leadership,

and department manager's benevolent leadership) are deemed as external stimuli, while pilots' self-efficacy and flight attendants' core self-evaluations are viewed as internal stimuli. Meanwhile, pilots' safety motivation and flight attendants' willingness toward conducting upward safety communication have been adopted as the organics in the current study. The definitions and linkages among all targeted variables will be stated in detail as follows.

The first section defines aircrew's position and describes their job contents. The second section deals with safety behavior in general and particularly in the aircrew duty context. The third section covers selected antecedents standing for organizational, group and individual aspects. Aircrew's perceived Safety Management System (SMS) practice representing organizational aspect is applied in both flight and cabin crews' safety behaviors models. Morality and benevolent leadership styles are employed as the group aspect's indictors in flight and cabin crews' safety behavior models respectively. Self-efficacy indicates individual factor linking to flight crew's safety motivation and behavior, while core self-evaluations symbolize cabin crew's individual aspect factor. The fourth and fifth sections review both mediators in the respective models, namely safety motivation and upward safety communication. It is aimed to organize the prior research to establish the fundamental of causal linkage for the conceptual models development. The last section capsules the reviewed literature and systematizes the underlying relations.

2.1 THE DEFINITION OF AIR CREW

Aircrew, consisting of flight crew and cabin crew, signifies the members who are assigned by aircraft operators to duty on airplanes during flight, being responsible for flight

operation, cabin service and safety. Aircrew members work together on board an aircraft to provide passengers a safe and satisfactory flight journey. While on duty, pilots are in charge of aircraft operation and flight attendants maintain cabin safety, guard cabin security and provide necessary service. According to the statistical data issued by the Council of Labor Affairs, Taiwan (2012), the number of flight attendants and pilots are ranked the first and the second in the total employee population working for Taiwanese airline industry (refer to Table 2.1).

Table 2.1 The Statistics of Employee Population in Taiwanese Airline Industry

Category	Number	Ratio
Total	18,597	100.00
Pilot	2,380	12.79
Flight Attendant	4,075	21.91

Source: Council of Labor Affairs, Taiwan (2012). *Survey on Earning by Occupation*.

The legal definitions and detailed job descriptions of flight and cabin crews are provided as follows.

2.1.1 Flight Crew

The general definition in Federal Aviation Regulations states that "flight crew member means a pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time" (FAA, 1962). Aircraft Flight Operation Regulations issued by Taiwanese Civil Aeronautics Administration defines flight crewmember as "a licensed crew member charged with duties essential to the operation of an aircraft during flight" (CAA, 2000). Depending on the length of flight hours, single, multiple or double flight crew is appointed to execute the flight operation. Flight crew works inside flight deck, also

termed cockpit, is responsible for operating aircraft in accordance with the procedures, standards and limitations prescribed in operating manuals and aircraft flight manuals without infringement. Based on the seniority and accumulated flight hours, pilots are ranked as first officer, also termed co-pilot, and captain. The captain designated by the operator, or the owner, as being command and charged with the safety conduct of a flight is named pilot-in-command (PIC).

2.1.2 Cabin Crew

Cabin crewmember is defined as "a crew member who performs, in the interest of safety of passengers, duties assigned by the operator or the pilot-in-command of the aircraft, but who shall not act as a flight crew member" (CAA, 2000). Albeit no legal requirements to regulate cabin crew's qualifications and job restrictions, all airlines establish a complete system of training programs to guarantee flight attendants being capable of dealing with regular and abnormal situations occurring on board. To ensure cabin safety and provide passengers pleasant service, including meal service, duty free sales and responding to a miscellaneous collection of requirements, flight attendants are necessitated performing multi-functional positions during flight. In particular, the critical role they serve demands the correspondents in the research of flight safety issues. Based on the seniority and flight experience, cabin crew is ranked as flight attendant, deputy purser and chief purser.

The qualifications of aircrew members are strictly regulated by local civil aviation authorities and airline companies. Flight crew and cabin crew undertake the great effort to both contribute to ensure passengers' pleasant flight experience under normal situations. In case of emergency, aircrew members are subject to PIC's commands to well prepare all people and facilities on board for minimizing the possible damage.

2.2 SAFETY BEHAVIOR

Safety behavior may be thought of as a type of employees' observable organizational behavior, which is focused on self-protection and contributed to enhancing safety performance within a specific work environment. The components of performance present the employees' individual actual behavior performing at work. Borman and Motowidlo (1993) propose two major components of performance: task performance and contextual performance, which later have been adopted in studying safety behavior of employees working in manufacturing and mining organizations (Griffin and Neal, 2000). Task performance can be defined as "the effectiveness with which job incumbents perform activities that contribute to the organization's technical core either directly by implementing a part of its technological process, or indirectly by providing it with needed materials or services" (Borman and Motowidlo, 1997, p. 99). Contextual performance, on the other hand, indicates activities which "contribute to organizational effectiveness in ways that shape the organizational, social, and psychological context that serves as the catalyst for task activities and processes" (Borman and Motowidlo, 1997, p.100).

Based on the distinction between task and contextual performance, Griffin and Neal (2000) have differentiated safety behavior into two types: safety compliance and safety participation. A comprehensive definition of safety behavior comprising employees' compliance with behavioral safety routines and proactively contributing to safety related work is stated. Safety compliance indicates the fundamental behaviors practiced by the employees to ensure the personal and workplace safety, which involves "adhering to safety procedures and carrying out work in a safe manner" (Neal et al., 2000, p. 101). Safety participation refers to the behaviors which help develop a safety-supportive environment instead of guaranteeing personal safety (Neal and Griffin, 2006). Helping co-workers,

promoting safety programs and volunteering for safety activities are all considered as safety participation behaviors.

Safety behavior increasingly gains attention with more research being focused on the human factors in work accidents (Fogarty and Shaw, 2010; Mullen, 2004; Neal and Griffin, 2006). While individuals develop a sense of job role on the basis of what they think that they are supposed or prefer to do (Graen, 1976), the similar development process is eligibly applied to observe the performance of safety behavior. Hofmann et al. (2003) extended the concept of role orientation to the occupational safety domain, and termed citizenship behaviors which are related to workplace safety as safety citizenship role definition. Based on the concept of organizational citizenship behavior (Podsakoff et al., 2000; Organ, 1988), which differentiates in-role (part of the role) behavior from extra-role (beyond the role) behavior, safety behavior may also be recognized as consisting of two categories of performance, compliance safety behavior and proactive safety behavior (Fugas et al., 2012).

Within the airline industry, pilots' safety behavior is consistently regarded as an important determinant of the overall safety performance. To a certain degree, pilots' individual safety behavior not only indicates their professional performance, but directly affects their airlines' safety record. Since being expected to work as flight managers, pilots not only have to practice, monitor and facilitate safety duties on board (Molesworth et al., 2006), but take the initiative to participate in safety related activities and advocate safety concepts.

Cabin crew's safety behavior protects people and facilities on board from being damaged or threatened. Correctly using protective equipment, abiding by safety policies and properly performing procedures to reduce the risk of potential hazards and injury are

what compliance safety behavior refers to. It is part of the work role which cabin crew is trained to practice. However, Didla et al. (2009) argues that employees' compliance with safety rules may merely prevent the accidents caused by violations passively, the continuous improvement of safety performance requires employees proactively participating in safety activities. As for cabin crew, helping other members on board to handle unexpected situations and putting in extra effort to promote safety concepts in the off-hours are regarded part of proactive safety behavior. It may also be deemed as extra-role behavior which is focused on safety. The bidimensional safety behavior approach describing cabin crew's safety behavior is consistent with the theoretical trend led by Griffin and Neal's (2000) two types of safety behavior: safety compliance and safety participation.

Air crew takes responsibilities to maintain flight safety. From protecting personal safety to enhancing airlines safety record, flight and cabin crews' safety behaviors are determinant to the ultimately observable consequences which airlines worldwide have been rated. This research thus focuses on identifying the potential factors which may enhance air crew's both safety compliance and participation (proactive) behaviors.

2.3 ANTECEDENTS OF AIRCREW'S SAFETY BEHAVIOR

The selected indicators represent organizational, group and individual aspects, which reflect the psychological mechanism indicating that individual's behavior stems from personal knowledge and values, group norms and organizational cultures that one operates within (Bill, 2003). Taking aircrew as an example, the specific personal characteristics of an individual are among the determining elements that decide whether someone is

appropriate for the position as being a pilot or flight attendant. In addition, organizational culture may unconsciously impact how aircrew members respond to the stereotypical images of flight and cabin crews. Moreover, airlines are composed of a variety of professional crews under the management of separate departments, and distinctive departmental subcultures and professional characteristics were observed in the prior qualitative research (Chen and Chen, 2011). Flight crew and cabin crew departments represent two of these specific groups. Aircrew's safety behaviors may thus be viewed as the result of a chain of social influence that combines individual, group and organizational attributes. Based on the context of aircrew's specific job characteristics and reviewing aircrew's safety behavior related research, the selected multi-factors are served as the predictors of aircrew's safety behaviors in the current paper and illustrated in detail in the following sections. As for the organization aspect factor, aircrew's perceived airlines SMS practice is applied in both of flight and cabin crews' studies to examine the linkage between it and aircrew's safety behaviors. As for the group aspect factor, the two sub-dimensions of paternalistic leadership, namely morality leadership and benevolent leadership are applied in the flight and cabin crews' safety behaviors research, respectively. Regarding the individual aspect factors, pilots' self-efficacy is employed to study its impact on their safety behaviors, while flight attendants' CSE is used to investigate how it may enhance cabin crew's safety behaviors.

2.3.1 Organizational Aspect: Safety Management System (SMS)

In the organizational aspect, the current study applies aircrew's perceptions of airlines' Safety Management System (SMS) practice as the indicator of an SMS in operation. SMS is regarded as an explicit element of corporate managerial responsibility, which sets out a company's safety policy and defines how it intends to manage safety as an integral part of

its overall business (UKCAA, 2002). The research has indicated that implementing a safety management system is the most efficient way of allocating resources for safety, since it not only improves working conditions, but also positively influences employees' attitudes and behaviors with regards safety, in consequence, improving organizational safety climate (Muñiz et al., 2007). As demanded by the International Civil Aviation Organization (ICAO), which set SMS as a regulatory standard for international airports in 2005, airlines worldwide must implement SMS as a mandatory policy since 1th, January 2009 (Maurino, 2007). In the airline industry, the approach for understanding and managing safety on an organizational level to identify hazards and manage risks is compulsory to meet safety requirement. As SMS provides the guiding for goal setting, planning, and measuring performance, which aims at weaving into the fabric of an organization and eventually becoming part of the culture to shape the way people do their jobs in the airlines industry (Transport Canada, 2001). The development of the Safety Management System (SMS) has thus been strongly promoted (Liou, et al., 2008).

2.3.1.1 The Definition of SMS

In 2002, the United Kingdom Civil Aviation Authority (UKCAA) published a guidebook (Civil Aviation Publication, CAP 712) titled "Safety Management Systems for Commercial Air Transport Operations", defining SMS as a methodology by which a company manages safety throughout its organization, utilizing a systematic approach to ensure that all parts of business are addressed, and that all risks are identified and subsequently managed (UKCAA, 2002). To buttress traditional reactive strategies for avoiding accidents, most civil aviation authorities promote SMS for its proactive systems approach (FSF, 2005). The Safety Management System is also recognized as a systematic approach to managing safety, including the necessary organizational structures,

accountabilities, policies and procedures (ICAO, 2006). FAA describes SMS as a term indicating that safety efforts are most effective when made part of business and government management of operations and oversight. Essentially, it is a quality management approach to controlling risk, also providing the organizational framework to support safety culture (FAA, 2006).

Based on leadership and accountability, SMS is a coordinated, comprehensive set of processes designed to direct all accessible resources to manage safety with the optimal utilization. It requires proactive data collection, information analysis, hazard identification, risk management, auditing and training, also including reactive incident and accident investigation and analysis. The essence of SMS is to take seemingly unrelated processes and build them into one coherent structure to achieve a higher level of safety performance, making safety management an integral part of overall risk management (IHST, 2007). As indicated by Civil Aviation Transport, Canada (2008), SMS is a business-like approach to safety and in keeping with all management systems.

The main objective of an SMS program for the airline industry is to establish an effective aviation safety culture which can detect and correct safety related problems before an accident occurred (Lewis, 2008). To sum up, SMS integrates the previously developed safety related concepts into a proactive model, which presents a framework of a dynamic Risk Management System based on Total Quality Management (TQM) principles. As Ott (2007) argue that an SMS may “ingrain a safety culture in a company, set up lines of responsibility and accountability, and reduce the accident and incident rates” (p. 56). The structure of SMS should be appropriate to the prevention of operational risks and proceed in a safety culture supportive environment.

2.3.1.2 The Components of SMS

Transport Canada published Guidance on Safety Management Systems Development (AC 107-001) in 2008 to replace the guidance material Safety Management Systems for flight operations and aircraft maintenance organizations (Transport Canada, 2002), providing instructions on some of the ways SMS can be implemented in large, complex organizations (Transport Canada, 2008). The Advisory Circular indicates six components of an integrated SMS, including: Safety Management Plan (Safety Policy, Non-Punitive Safety Reporting Policy, etc.), Documentation (Identification and Maintenance of Applicable Regulations, SMS Documentation, etc.), Safety Oversight (Reactive Process - Reporting, Proactive Process - Hazard Identification, etc.), Training (Awareness and Competence), Quality Assurance Program (Inspection and testing methods, Internal and external audits, etc.) and Emergency Response Plan (Appropriate Emergency Preparedness Procedure, Periodically Reviewed, etc.).

The three core features of SMS are that it is as followings: (1) Systematic: safety management activities are in accordance with a pre-determined plan, and applied in a consistent manner throughout the organization. (2) Pro-active: it is an approach that emphasizes hazard identification and risk control and mitigation, before events that affect safety occur. (3) Explicit: all safety management activities are documented and visible and performed independently from other management activities (Hsu, 2008; ICAO, 2006; Kohli, 2007).

To define the requirements for the Safety Management System in Aviation Safety (AVS), the Federal Aviation Administration (FAA) issued the Order VS 8000.367 (FAA, 2008). The four main components of the AVS SMS are as follows: (1) Safety Policy: which includes the statement of goals and objectives for AVS to fulfill, as well as staffing

and planning. (2) Safety Risk Management: which includes the forward looking identification of hazards in the air transportation system, analyzing and assessing their risk, and controlling them (as required). (3) Safety Assurance: which gathers data on the air transportation system, analyzes and assesses it to determine if the safety risk controls generated in Safety Risk Management are effective, and if not, makes decisions regarding what appropriate corrective actions should be taken. (4) Safety promotion: includes communication, training, and the development of a positive safety culture. The Australian Civil Aviation Safety Authority (CASA) has also continuously increased the guidance to promote SMS. Eight elements of SMS, including Safety policy and objectives, organizational and staff responsibilities, Establishment and monitoring of levels of safety, Internal safety reviews, Internal reporting and management of safety concerns and incidents, Hazard identification/assessment/control and mitigation, Interfaces, and Change management, were illustrated in AC 172-01(0) (CASA, 2005). To comply with the requirement of SMS implementation by ICAO, CASA published the Notice of Final Rule Making (NFRM) 0803OS (CASA, 2009) to provide the final regulations and associated advisory materials.

To further extend the application of SMS, ICAO (2013) has issued the 3rd edition of Safety Management Manual (SMM) and Annex19－Safety Management to provide States with guidance on the development and implementation of a State safety programme (SSP), in accordance with the International Standards and Recommended Practices (SARPs) contained in Annex 1－Personnel Licensing, Annex 6－Operation of Aircraft, Annex 8－Airworthiness of Aircraft, Annex 11－Air Traffic Services, Annex 13－Aircraft Accident and Incident Investigation and Annex 14－Aerodromes, Volume I－Aerodrome Design and Operations (p.1-1). Five objectives of an SSP, which contains four components with 11 elements, are stated as follows. (1) Ensure that a State has the minimum required

regulatory framework in place; (2) Ensure harmonization amongst the State's regulatory and administrative organizations in their respective safety risk management roles; (3) Facilitate monitoring and measurement of the aggregate safety performance of the State's aviation industry; (4) coordinate and continuously improve the State's safety management functions; and (5) support effective implementation and interaction with the service provider's SMS (p.4-1).

Safety may be defined as a state in which risk is reduced to and maintained at an acceptable level through a continuing process of hazard identification and risk management. As an integrated system to achieve this goal, an effective SMS should contain the completed processes for planning and measuring safety performance, ensuring all personnel are well-trained and competent, identifying safety hazards, evaluating and managing risks. Furthermore, on a periodic basis, the system must proactively undertake the internal reporting and analysis of safety hazards, incidents and accidents, and also take corrective measures to prevent their recurrence. For safety awareness and communication, it is important to ensure that all personnel are aware of their roles and responsibilities within the system. To control the total quality, a documentation of all SMS processes and a process for conducting reviews or audits of the SMS are indispensable.

The key components, elements, plans and steps to implement an SMS given in the official documents issued by the international aviation organizations (including the Australian Civil Aviation Safety Authority, International Civil Aviation Organization, Federal Aviation Administration, Transport Canada, the United Kingdom Civil Aviation Authority and Taiwan Civil Aeronautics Administration) are summarized in Table 2.2.

Table 2.2 The SMS Key Components / Elements /Implementation Plans/ Steps

Authorities	Key components / elements / implementation plans / steps
CASA (2003, 2005)	4 key elements (2003) ● Top level management committed to safety ● Systems are in places to ensure hazards are reported in a timely manner ● Action is taken to manage risks ● The effects of safety actions are evaluated 8 key elements (2005) ● Safety policy and objectives ● Organisational and staff responsibilities ● Establishment and monitoring of levels of safety ● Internal safety reviews ● Internal reporting and management of safety concerns and incidents ● Hazard identification / assessment / control and mitigation ● Interfaces ● Change management
ICAO (2006, 2013)	10 steps (2006) ● Planning ● Senior management's commitment to safety ● Organization ● Hazard identification ● Risk management ● Investigation capability ● Safety analysis capability ● Safety promotion and training ● Safety management documentation and information management ● Safety oversight and safety performance monitoring 4 key components with 11 elements (2013) ● State safety policy and objectives - State safety legislative framework - State safety responsibilities and accountabilities - Accident and incident investigation - Enforcement policy ● State safety risk management - Safety requirements for the service provider's SMS - Agreement on the service provider's safety performance ● State safety assurance - Safety oversight - Safety data collection, analysis and exchange - Safety-data-driven targeting of oversight of areas of greater concern or need ● State safety promotion - Internal training, communication and dissemination of safety information

Table 2.2 The SMS Key Components / Elements /Implementation Plans/ Steps

(continued)

	- External training, communication and dissemination of safety information
FAA (2006, 2010)	4 key components ● Policy ● Safety risk management ● Safety assurance ● Safety promotion
Transport Canada (2008)	6 key components ● Safety management plan ● Documentation ● Safety oversight ● Training ● Quality assurance program ● Emergency response plan
UKCAA (2010)	11 contents of implementation plan ● Safety policy ● Safety planning, objectives and goals ● System description ● SMS components ● Safety roles and responsibilities ● Safety reporting policy ● Means of employee involvement ● Safety communication ● Safety performance measurement ● Management review of safety performance ● Safety training
Taiwan CAA (2007, 2011)	4 key elements ● Safety policy and objectives ● Safety risk management ● Safety assurance ● Safety promotion

2.3.1.3 The Application of SMS in Taiwan

Referring to AC120-92 (FAA, 2006), the Civil Aeronautics Administration (CAA) of Taiwan published AC120-32B to replace AC120-32A in 2007. The contents illustrate the principles and functions of SMS and the relationship between protection and production. Based on these measures, all airlines in Taiwan needed to implement SMS before January

01, 2009 (CAA, 2007).

The continuous improvement of the air safety record demonstrates the determination of air transport operators in Taiwan to take the issue of safety seriously. Taking Airline A as an example, it has been awarded the coveted Gold Wing by Taiwan's CAA and is ranked as one of the world's top-10 safest carriers by Aero International Magazine in Germany. The principles of SMS which all employees working for Airline A have to keep in mind are summarized as follows: "Based on morals, we shall develop the spirit of teamwork in a precise, diligent, solid and creative manner. To secure the safety of personnel and aircraft, we have to do the things right at the first time and strive for the largest safety margin." As well as using technologically advanced flight analysis equipment (such as Aircraft Condition Monitoring Systems (ACMS) and Aircraft Communications Addressing & Reporting Systems(ACARS)) to track aircraft operations, engine conditions and flight performance, the airline also continuously upgrades the levels of employees' professional knowledge and skills by designing and offering courses for on-the-job training. The three targets of SMS with flight operations are zero serious incidents, minimizing errors and zero violations. To achieve these goals, Airline A clearly follows four strategies: (1) collect and examine good quality data from events, training, checks, Line Observation Program (LOP), Flight Data Information System (FDIS), Flight Operation Safety Performance Indicator (FOSPI) and investigations; (2) apply corrective action rather than punitive measures except for willful violations; (3) share relevant data with all staff to ensure they know which areas need extra attention; and (4) require that all staff adopt best practices to ensure quality in Flight Operations. To build an integrated and adaptable SMS, a high-quality organizational culture with professionalism is a prerequisite. Airline A thus proposes that the ideal organizational culture should be knowledgeable, impartial, adaptable and learning. As such routine activities to enhance the execution of SMS, regular training programs are

offered on a periodic basis. In addition, the company's Safety and Security Division will host various competitions during the period of "Safety Week". It also encourages and rewards all staff to participate in the Safety Voluntary Report System to address any concerns or suggestions regarding aviation operation safety issues (CSCA, 2008).

Airline B, as another example, implements comprehensive SMS to improve to corporate safety. To share the safety information with fellow members and learn from their experiences, it joined the IATA (International Air Transport Association) STEADES (Safety Trend Evaluation, Analysis and Data Exchange System) program in 2005. Applying IOSA (IATA Operations Safety Audit) as the system safety standard, Airline B presented its ambition to achieve an international standard of air safety. From reactive safety investigation to proactive and predictive safety management, Airline B ultimately seeks information from a variety of sources which may reveal potential safety risks. Progress in this area may be reflected by the continuously increasing number of reports filed via company's E-reporting system, which has been established to collect data at all times, indicating a positive change in the firm's safety culture (CSCA, 2008)

Airlines rely on the practice of an SMS to integrate safety policies and augment safety performance at both organizational and individual levels (Chen and Chen, 2011). One of the keys to achieving successful implementation of an SMS is to ensure that every employee participates in the system and fulfills their designated roles. Galotti et al. (2006) indicated "system" as the concept of an integrated set of processes which manages safety across intra-departmental boundaries. Hsu et al. (2010) indicate that "Organization is the most important dimension and has the largest effect on other dimensions in an airline SMS, which begins with Policies that convey top managers' viewpoint and vision on safety" (p.235).

How employees evaluate the companies' SMS practice may signal the effects of adopting such proactive safety model in practice within the organization. Aircrew's assessment of airlines SMS practice demonstrates their perceptions on the effect of airline's endeavor to embody organizational safety culture. Aircrew's perception of the airlines SMS practice thus is appropriate to serve as the organizational aspect factor to investigate the relationship between it and aircrew's safety behaviors. Previous studies have provided the evidence to support the positive relationship between the implementation of SMS and the attitudes of employees towards safety behaviors in aviation related industries (e.g. Remawi et al., 2011). However, there is lack of empirical data to support the direct and positive relationship between airlines SMS practice and aircrew's safety behavior. Accordingly, this study predicts that the better pilots and flight attendants perceive SMS practice within airlines, the stronger motivation they have to perform safety behaviors, and the perceptions may be directly reflected on their actual safety behaviors.

2.3.2 Group Aspect: Morality Leadership and Benevolent Leadership

Among the various factors that affect employee attitudes and behaviors, Yukl (2002) propose that leadership of group managers has a powerful effect on employee work behaviors. There are numerous ways of viewing leadership and various interpretations of its meaning (Mullins, 1999). In general, leaders are regarded people who are capable of converting their beliefs and visions into reality, via exercising the control and influence over followers (Bennis and Nanus, 1985). Hersey and Blanchard (1982) argue that leadership is a process of interaction between managers and subordinates toward the establish goal. Afterward Schilbach defines leadership as "an interpersonal process through which a leader directs the activities of individuals or groups towards the purposeful

pursuance of given objectives within a particular situation by means of communication" (in Gerber et al., 1996, p. 343).

It is positively confirmed that leadership has an effect on individual well-being to working adults (Gilbreath and Benson, 2004). Particularly, Clarke (2006) proposes that leadership style has a significant impact on employees with regard to their safety participation. Leaders who express concerns in followers' personal and professional development, and may instill confidence and behaves in admirable ways that lead the followers to identify with them are expected to motivate subordinates aligning their own self-concept with the group (Clarke, 2013). The causality between leadership and employee safety behaviors has been supported by a number of related studies (e.g. Hofmann and Morgeson, 1999; Nahrgang et al., 2011; Yang et al., 2009; Zohar, 2002; Zohar and Luria, 2003). For instance, Hofmann and Morgeson (1999) propose that the good quality of exchange relationships with supervisors is associated with safety-related communication, which is significantly related to safety commitment and less accidents. Zohar and Luria (2003) also argue that the more increased the supervisor's safety-oriented interaction with employees, the more significant changes are observed in workers' safety behavior and safety climate scores. Yang and his colleagues empirically tested the relationship between leadership behavior, safety culture and safety performance in the healthcare industry, and found that leadership behavior affects safety culture and safety performance (Yang et al., 2009). Among the prior research related to the linkage between leadership and safety outcomes, transformational leadership has been most commonly identified as a predicting variable (Barling et al., 2002; Clarke, 2013; Kelloway et al., 2006; Yang et al., 2009; Zohar, 2002). Clarke (2013) conducted a meta-analytic review of transformational leadership style being as an antecedent of safety behaviors, developing a theoretical model and providing the evidence to support that transformational leadership is

positively associated with both perceived safety climate and safety participation. Although these previous studies provided a solid framework to link transformational leadership style and employee safety behaviors, the current paper employs paternalistic leadership (Farh and Cheng, 2000) to investigate its effects on aircrew's safety behaviors with the specific approach.

Being consistent with the Leader-Member Exchange (LMX) theory, transformational leadership has been found to be positively related to subordinates' satisfaction and ratings of leader effectiveness (Seltzer and Bass, 1990), performance (Kirkpatrick and Locke, 1996), identification with the group belongingness (Cremer and Knippenberg, 2002), empowerment (Kark et al., 2003) and employee commitment (Rafferty and Griifin, 2004). The similar results have been indicated in the related research regarding the effects which paternalistic leaders have on their followers (e.g. Cheng et al., 2000; Erben and Güneşer, 2008; Farh et al., 2006). Nevertheless, some conceptual distinctions of the two leadership styles require attention. Transformational leadership is a communicative management approach associating with the contemporary western style, which is valued as an effective tactic to conduct management in both individualistic and collectivistic cultures (e.g., Bass, 1997; Leung and Bozionelos, 2004). Paternalistic leadership, on the other hand, is deeply rooted in Chinese cultural values and expresses the traditional Chinese way of life. Cheng et al. (2004) argue that paternalistic leadership is more long-term oriented and extends beyond being thoughtful majorly on the job to the followers' personal issues. Chemers (1993) advocates that leadership, although its quasi-universal, is embedded in culture and nationality.

For a long period of time, paternalistic leadership style and group harmony, have exerted a strong influence on the relationships between leaders and subordinates in the

Greater China region, where relationship-oriented culture is found predominant (Tsui et al., 2004; Xin and Pearce, 1996). Hsu and Lee (2012) conducted a quantitative research by collecting data from frontline workers of high-risk industries in Taiwan and found that management involvement and harmonious relationship significantly impact individual risk awareness and safety practices, through the mediative effect of safety supervision. As paternalistic leadership style embedded in the relationship-oriented culture highly values dignity, loyalty to organizations, and harmonious working relationship, it may thus well represent the group aspect indicator in the current research, which targets at the aircrew working in Taiwanese international airlines.

Paternalistic leadership has been a flourishing research area in management literature in the recent decades, but the definition and effectiveness of paternalistic practices are still considerably disparate (Pellegrini and Scandura, 2008). In early stage of development, researchers argued that within a paternalistic system, obedience is owed to the leader merely by virtue of their status, as paternalism is regarded one of the most elementary types of traditional domination (Weber, 1968). Later, opposing to viewing paternalism as the absolute authoritarianism, a number of studies described paternalism as a fatherlike leadership style that combines managers' support, protection, care and authority toward subordinates (e.g. Redding et al., 1994; Westwood and Chan, 1992).

Gelfand et al. (2007) define paternalism as a "hierarchical relationship in which a leader guides professional and personal lives of subordinates in a manner resembling a parent, and in exchange expects loyalty and deference" (p. 493). Paternalism is congruent with the values of collectivistic and high-power distance cultures, which are prevalently observed in Asian, Middle-Eastern and Latin American (Aycan, 2006). In traditional Chinese societies, leaders enact a paternalistic role with fatherly benevolence (Cheng et al.,

2000; Pellegrini and Scandura, 2008). The construct of paternalistic leadership has been recommended to present the fundamental features of Chinese business leaders' behaviors in either family business or modern organization (Farh and Cheng, 2000; Westwood, 1997). The studies conducted in the Chinese context also demonstrate the validity of paternalistic leadership in predicting employee job attitudes and performance (Cheng et al., 2000; Farh et al., 2006).

The domain and practice of paternalistic leadership has mainly been contributed to the research conducted by Farh, Cheng, their colleagues (Farh and Cheng, 2000; Farh et al., 2006), and Aycan (2006). Based on the results of a series of research, Farh and Cheng (2000) proposed a model of paternalistic leadership which consists of three dimensions instead of being a unified construct, including morality, benevolence and authoritarianism. Among these three distinct dimensions, morality and benevolent leadership styles have been identified to be positively related to employees' job outcomes, while authoritarian leadership reveals the adverse effect (e.g. Cheng et al., 2002; Chou et al., 2005; Erben and Güneşer, 2008; Pellegrini et al., 2010). Although paternalistic leadership has been widely adopted as the representative of Chinese leadership style, it has not yet been examined in the context of Taiwanese international airlines, the current research target per se, which are viewed as rooted in Chinese culture but aiming to be internationalized. Furthermore, commercial airlines' aircrew members and their safety specific behavior are both under limited discussion in the existing literature. To expand the application of paternalistic leadership, how fleet managers' morality leadership may affect flight crew's safety related behaviors, and the impact of department managers' benevolent leadership has on cabin crew's safety behavior are investigated in the current study. Both morality leadership and benevolent leadership are respectively illustrated in detail in the following sections.

2.3.2.1 Morality Leadership

Morality leadership refers to a leader who displays superior personal virtues through acting unselfishly (e.g., never promote one's private interests under the guise of serving the public; does not abuse authority for personal gain), thus gains subordinates' respect and identification with him/her. Leaders are obligated to set a moral example for their subordinates (Aronson, 2001). Those who perform morality leadership tend to serve as role models for employees and exert referent power on them (Chen et al., 2011). Chinese traditions highly value personal moral integrity. Moral leaders are thus greatly respected, admired, and viewed as ideal leaders by Chinese employees, for their demonstration of integrity and concerning with the collective benefits rather than being self-interested (Chen et al., 2011; Niu et al., 2009). Previous research has confirmed that morality leadership positively predicts employees' organizational citizenship behavior (Chu and Hung, 2009; Cheng et al., 2002; Chou et al., 2005), obligation toward others (Aycan et al., 2000) and organizational commitment (Farh et al., 2006).

Differing from most of service industries, an airline's safety record is seen as its most important performance indicator by customers (Liou and Chuang, 2010). An airline's safety record can also be viewed as the collective moral behaviors carried out by its employees, and thus it is expected that an airline's various crews (e.g. cockpit, cabin and maintenance crews) should present an extreme level of morality in their work performance to enhance safety. As moral leaders consistently demonstrate ethical behavior in both professional and private aspects, its positive consequence on increasing the level of subordinates' trust has been observed (Treviño et al., 2003). Conchie et al. (2006) have referred trust as the "missing piece of the safety puzzle". It implies that the more the followers trust their leaders, the stronger motivation they possess to devote for safety

performance. Since pilots have an overwhelming obligation to ensure flight safety, it is noteworthy to explore the possible impact of morality leadership on pilots' safety motivation and actual safety behaviors.

In practice, pilots are qualified for particular cockpits (Clarke et al., 1996). Based on their specific licenses and aircraft type rating endorsement, commercial airlines pilots are grouped into designated fleets to carry out their flight duties. Fleet managers are selected from well-experienced captains, and they work to maintain a fleet's operational standards and procedures, as well as to ensure pilot training standards and work related discipline. The leadership enacted by fleet managers is believed to have a significant influence on pilots' behaviors, as there is considerable evidence to support the causal link between leadership and the performance of subordinates (Barling et al., 2002; Jong and Hartog, 2007). Therefore, examining whether fleet managers' morality leadership style enhances pilots' motivation to perform safety behaviors may provide the crucial insights into the underlying themes linking leadership and employee behaviors. Meanwhile, the present paper examines the flight crews working for Taiwanese international airlines, which are regarded as the international organizations embedded in Chinese culture, it is believed that this study's examination of whether morality leadership enhance pilots' safety behaviors can add to the literature by extending current understanding of this and related topics.

Accordingly, it is believed that morality leadership will likely motivate subordinates to put more effort into work and go above and beyond the call of duty for their leaders (Colquitt et al., 2007). Consistent with the suggestion of prior research that morality leadership is positively related to employees' organizational behavior (e.g. Cheng et al., 2002), this paper hypothesizes that airline fleet manager's morality leadership may motivate pilots to conduct safety behaviors

2.3.2.2 Benevolent Leadership

Benevolent leadership depicts a leader who demonstrates individualized, holistic concern for subordinates' well-being, both personal and familial (Cheng et al., 2004; Farh and Cheng, 2000; Wang and Cheng, 2009). Karakas and Sarigollu (2011) define benevolent leadership as "the process of creating a virtuous cycle of encouraging and initiating positive change in organizations through: a) ethical decision making, b) creating a sense of meaning, c) inspiring hope and fostering courage for positive action, and d) leaving a positive impact for the larger community" (Karakas and Sarigollu, 2011, p. 537).

Benevolent leaders tend to act like parents and provide attentive care in their followers' work and personal lives. The protection and care provided by leaders are logically accumulated in exchanging for subordinates' trust, loyalty and support. Prior research presented a consistent result that benevolent leadership performed in Chinese enterprises strongly enhances employees' respect, gratitude and commitment to the leaders (Cheng et al., 2004; Farh et al., 2006). In the research of Cheng et al. (2004), the empirical data show that benevolent leadership has the strongest effect on employees' identification with the leaders, as well as being the one to be most conducive to subordinate gratitude. The consistent findings are also observed by Farh and Cheng (2000), who claim that benevolent leadership arouses subordinates' feelings of obligation to their role, such as loyalty and obedience in the Chinese context. Furthermore, Wang and Cheng (2009) offer the empirical evidence to indicate that benevolent leadership may significantly stimulate employees' creativity through the positive moderating effect of job autonomy. Although the positive effect induced by managers' benevolent leadership reflects on a variety of employees' favorable work outcomes, for example, job performance, organizational commitment and citizenship behavior (Erben and Güneşer, 2008; Farh et al., 2008), the

extant literature is marked by some limitations. One is the lack of concerning with the causal relationship between benevolent leadership and employees' safety related performance. It leads to one of the primary goals in the current study which aims to establish theoretical bases in connecting managers' benevolent leadership and subordinates' safety behavior.

The leadership enacted by managers is believed to have a significant influence on how crew members feel, think, and behave at work, as there are considerable evidences to support the causal link between leadership and the performance of subordinates (Barling et al., 2002; Jong and Hartog, 2007). What makes benevolent leadership being different from other leadership concepts is its central emphasis on developing observable benefits, actions, or results for the "common good" (Karakas and Sarigollu, 2011). The phrase "common good" is coined to describe the concept of shared benefits or positive outcomes for all or most members belonging to a community (Bryson and Crosby, 1992; Daly and Cobb, 1989). To develop a conceptual linkage between cabin crew department managers' benevolent leadership and flight attendants' safety behavior, it is essential to appreciate cabin crew's specific job characteristics. Cabin crew duty is well-known to symbolize the concept and job characteristics of teamwork. Working in the air, the particular job characteristics require cabin crew to live under a shifted schedule. The huge job demands come from physical, psychological and emotional labors often result in cabin crew's mental or physical health problems (Chen and Chen, 2012b; Heuven and Bakker, 2003). Furthermore, the work family conflict is obviously detected in the majority of flight attendants (Chen, 2006; Xanthopoulou et al., 2008). Being the first line operator, cabin crew has a tremendous need for being fully supported in order to leave all worriment behind and present their best performance in front of the passengers. The parental care and backup expressed by benevolent leaders and the appreciation of striving for "common

good" are expected to boost the coherence among cabin crew and motivate the exercise of teamwork to achieve the shared goals.

Previous research has concurred that benevolent leadership is positively related to employees' organizational citizenship behaviors and self-ratings of performance (Chen et al., 2011; Cheng et al., 2002; Chou et al., 2005). To extend the appreciation regarding benevolent leadership's effect in the airline business context, this study aims to explore whether the similar linkage between benevolent leadership and cabin crew's safety behaviors exists. More specifically, the current research will examine how benevolent leadership may motivate cabin crew's upward safety communication, safety compliance and participation behaviors.

2.3.3 Individual Aspect: Self-efficacy

The current paper adopts self-efficacy as the individual aspect's indicator to explore how it may enhance pilots' safety behaviors. Self-efficacy was first employed in psychological research, serving as a critical determinant for explaining and predicting behavioral changes in an individual by the psychologist Albert Bandura (Bandura, 1977a). He recognized self-efficacy as "concerned not with the number of skills you have, but with what you believe you can do with what you have under a variety of circumstances" (Bandura, 1997b, p. 37). According to attribution theory (Weiner, 1980), a high achiever (motivated person) is inclined to approach rather than avoid tasks related to succeeding since they believe that success is contributed to high ability and effort which they are confident of. Bandura (1997a) also proposed that expectations of personal efficacy rely on four major sources of information, namely performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal. Regarding performance accomplishment, Bandura emphasized that repeated successes are likely to enhance

efficacy expectation and reduce the negative impact of occasional failures. Vicarious experience represents the situation in which people tend to persuade themselves that if others can accomplish particular tasks, they should be able to achieve at least some improvement in related performance (Bandura and Barab, 1973). In addition, people who are verbally persuaded that they may successfully master difficult situations and are provided with provisional aids for effective deeds are apt to mobilize greater efforts than those who receive the performance aids only (Bandura, 1997a). As for emotional arousal, according to the theory of rational emotive behavior therapy (Ellis, 1994), this is conceived of as a drive that activates avoidance behavior. However, social learning theory (Bandura, 1977) views physiological arousal as both informative and motivating. The theory states that the cognitive appraisals of arousal to a great extent determine the level and direction of motivational inducements to action.

Self-efficacy can be also defined as team members' perceived capability to perform the required activities for the team tasks (Konradt and Andreben, 2009). Perceived self-efficacy reflects people's beliefs in their capabilities to conduct designated levels of performance, which produce influence over events that constantly affect their lives. Studies reveal that people with low self-efficacy tend to become unreliable and unpredictable when engaging in a task. Contrarily, people who have high self-efficacy often take a wider overview of a task in order to take the best route of action (Bandura, 1997a, b). Garland et al. (1988) proposed that the operator's self-efficacy will enhance the motivation of persisting and exerting effort to accomplish the task. It is recognized that the beliefs of self-efficacy may determine how people feel, think, motivate themselves and behave (Bandura, 1997a, b).

Undoubtedly, pilots undertake tremendous burdens both psychologically and

physically due to the job responsibility and characteristics (Nicholas et al., 2001). Working with shifted schedule in a confined space, posing and answering numerous navigation and situation assessment questions at different phases in the flight timeline, being well aware of any unexpected conditions and making the best decision within limited time and resources to protect aircrafts and people on board, aforementioned tasks accumulate great demands to pilots (Loukopoulos et al., 2003). Furthermore, along with the continuous development of modern technology, flight operation increasingly grows toward computerized. Aside from being airplanes operators, pilots are obligated to enhance their knowledge and skills for qualifying the role as a flight manager.

Instead of merely focusing on operating an airplane, which may be seen as a flight operator, pilots nowadays are regarded as managers who command aircrew and passengers on board to guarantee a superb flight experience. Such position requires challenge appraisal individuals to better cope with various circumstances (Skinner and Brewer, 2002). As efficacious people believe in their own capabilities to produce effects, the pilots with higher level's self-efficacy are expected to confront the challenge and exert the effort to improve proficiency. Correspondingly, personal attributes have been emphasized with the influences to the pilots' unsafe behaviors in the previous research (Ji et al., 2011).

While investigating pilots' work related behaviors, individual self-efficacy has been applied to be the observed predictor in the previous research (e.g. Parasuraman et al., 1993; Prinzel, 2002). Related studies also demonstrate that self-efficacy has effects on the level of motivation, learning and performance (e.g. Schunk and Pajares, 2001). Although some researchers claim that self-efficacy may be regarded as a double-edged sword (e.g. Prinzel et al., 1999), which possibly leads to the concern that pilots with high self-efficacy may be more likely to take dangerous short-cuts because of overconfidence. The key point thus

should be how to maximize the positive effects and reduce the negative ones. In practice, Taiwanese airline companies have increasingly adopted flight analysis equipment (such as Aircraft Condition Monitoring Systems, ACMS, and Aircraft Communications Addressing & Reporting Systems, ACARS) to track aircraft operations, engine conditions and flight performance(Chen and Chen, 2011). Therefore, flight operations in the cockpit are under regular monitoring to prevent any improper behaviors, and the space for flight crews to take dangerous short-cuts has been greatly limited. Furthermore, pilots are the ultimate ones in charge of flight operations and safety. They not only have to execute the designated tasks, but also expected to fulfill the responsibility of being a flight manager. The challenges pilots may encounter are thus not restrained to flight operations under regular or abnormal situations. The critical role of flight manager requires pilots to devote greater efforts to continuously enhance their leadership skills. Pilots with higher self-efficacy are hence believed to perform better in such positions.

With the statement made by Graham and Weiner (1995) that self-efficacy is a consistent predictor of behavior and behavior change, this paper observes whether self-efficacy may trigger flight crew's safety motivation and generate their safety behaviors to expand the understanding of the causality relationship in the individual level.

2.3.4 Individual Aspect: Core Self-evaluations (CSE)

The conceptual model of cabin crew's safety behavior adopts core self-evaluations (CSE) as the individual-aspect predictor to examine how they affect flight attendants' safety behaviors. CSE is a higher order concept representing the fundamental evaluations that people assess themselves and their functioning in the environment (Judge, 2004).

Individual different constructs are determinants to influence how one behaves.

Personality traits, emotional stability, self-efficacy or self-esteem are among the popularly focal antecedents which psychological studies apply to link with individual work outcomes (e.g. Barrick and Mount, 1991; Hogan, 1996; Judge et al., 2000; Wiggins, 1996). There are sufficient references supporting the argument of aforementioned personal traits being highly intercorrelated and exhibiting strikingly similar relationships (Bono and Judge, 2003; Francis, 1996; Roseberg, 1965). One criticism of the dispositional approach was the expansion of research on individual variables lacking the integrative theory. Accordingly, Judge et al. (1997) integrate four traits into a valid psychological construct and coin it "core self-evaluations", consisting of self-esteem, locus of control, neuroticism (or emotional stability), and generalized self-efficacy, which refers to individuals' fundamental, bottom-line evaluations affecting their appraisal regarding self-worth, competence, capabilities and how they value the world and others.

Self-esteem is an overall appraisal of one's self-worth (Rosenberg, 1965). It is most closely associated with the personality traits of emotional stability, extraversion, and conscientiousness (Robins et al., 2001; Watson et al., 2002). Differentiating from work related self-efficacy, which adopted as the individual aspect antecedent of pilots' safety behavior model in the current paper, generalized self-efficacy describes a broad and stable sense of one's ability to perform and cope efficiently within a variety of stressful situations (Chen et al., 2001). Emotional stability is the inclination to feel calm and secure (Eysenck, 1990). An emotionally stable person could be expected to be imperturbable and complain little about his/her personal worries and anxieties (Hills and Argyle, 2001). As for locus of control, it refers to the belief that desired effects derive primarily from one's own behavior rather than by fate or powerful others (Rotter, 1966). Kormanik and Rocco (2009) denote locus of control being the difference in the way one perceives life's rewards and punishments. People with an internal locus of control believe that both reward and

punishment are contributed by personal behavior and actions. Oppositely, someone with an external locus believes that outside forces govern their fate. Judge et al. (1997) argue that these four traits are interrelated and share similar relations with other variables. In support of this view, empirical findings have confirmed that the traits are highly correlated (e.g., Judge et al., 2002). The four traits load on a higher order factor (e.g., Judge et al., 2000), and they have similar relations with job satisfaction and performance (Judge and Bono, 2001).

At a primary level, people with high-CSE are commonly characterized by self-confidence, self-worth, self-potency, and freedom from anxiety (Hiller and Hambrick, 2005). Similar to other personal traits, CSE has been adopted as the predictor to examine the causal relations with individual's work performance. Job satisfaction and job performance are by now the two central criteria of interest to Industry/Organization psychologists regarding both conceptual and empirical relationships with the selected traits of core self-evaluations (Bono and Judge, 2003; Erez and Judge, 2001; Judge and Bono, 2001; Rich et al., 2010). Research found that people with positive self-evaluations not only are more effective in overcoming obstacles by using better problem solving strategies, they also perform better in positions requiring positive interpersonal relations or stress tolerance (Bono and Judge, 2003).

People with high CSE are assumed to have positive self-identification and achieve better performance (Erez and Judge, 2001; Judge and Hurst, 2007). Working in the sky, the duties of cabin crew are widely-known as a form of emotional work (Hochschild, 1983). Flight attendants work under tremendous stress caused from a variety of passengers issues (unruly or demanding passengers) or unexpected situations (both facets of service and emergency) occurring on board an airplane, though the negative consequence of cabin

work tends to be embellished covered by its gorgeous and attractive job image with the additional benefits. Flight attendant position continuously remains highly competitive in Asia even the heavy job demands have gained increasing attention practically and academically in the recent decade (Chen and Chen, 2012b; Liang and Hsieh, 2005). No doubt that experience and substantial support from the organizations are essential for cabin crew members to constantly cope with various types of uncertainty both at work and in personal lives. On top of that, the significance of inherent personal characters should not be underestimated. Since dexterous interpersonal skill and sufficient stress tolerance are considered cabin crew's critical qualifications, people who perceive themselves with high core self-evaluations are expected to better perform the position as cabin crew.

The relation between core self-evaluations and job performance, including task performance and organizational citizenship behaviors (OCB), has been confirmed in a number of studies (Judge et al., 1998; Piccolo et al, 2005; Sheykhshabani, 2012). Cabin crew members are obligated to carry out multiple tasks and consistently remain emotional stable at work, thus it is assumed that flight attendants with high CSE may be more self-motivated to conduct safety behaviors. Accordingly, this research intends to extend the linkage by examining whether cabin attendants' core self-evaluations enhance their safety behaviors, namely upward safety communication, safety compliance and safety participation. While considering cabin crew's safety behaviors as the organizational behaviors focusing on safety related performance, the results of this study may help indicate whether the existing causality between CSE and OCB duplicates in the safety contexture.

2.4 FLIGHT CREW'S SAFETY MOTIVATION

In the conceptual model of pilots' safety behaviors research, safety motivation serves as a mediator. Since behavior development is a complex process, whether potential antecedents may directly lead to pilots' safety behaviors requires further examination. Besides, with the difficulties of observing pilots actual safety behaviors in practice, assessing flight crew's safety motivation may provide collateral evidence to link the hypothetical causalities raised in the conceptual model, as it is widely accepted that motivation will lead to actions (Ames, 1990). Although there is no universal agreement on the definition of motivation, most psychologists describe it as any internal condition that appears by inference to initiate, activate, or maintain goal-directed behavior (Lefton and Brannon, 2002). Motivation may be triggered by both intrinsic needs and extrinsic incentives. Maslow's Theory of Needs (1954) states that individuals are motivated to reach higher level needs such as self-esteem and self-actualization only after lower level needs such as belongingness and safety needs have been confirmed. Social exchange theory (Blau, 1964) proposes that employees will devote efforts to benefit organizations if their well-being has been well concerned.

Motivation has turned into the focal factor in the literature of employee work behavior with the research trend led by Elton Mayo, who has conducted a series of studies referred to as Hawthorne Studies (Dickson, 1973). It has commenced the human relations approach to management. The needs and motivation of employees has become the primary focus of managers in practice since then (Bedeian, 1993). Likewise, academically many researchers follow the publication of the Hawthorne Study results to explore what motivate employees and how they are motivated (Terpstra, 1979).

Safety motivation refers to an individual's willingness to exert effort to perform safety

behaviors and the valence associated with those behaviors (Neal and Griffin, 2006). It can also be perceived as attitudes and perceptions relating to the influences motivating safe or unsafe behavior (Willamson et al., 1997). Campbell et al. (1993) indicate that motivation is one of the determinants of individual performance. Griffin and Neal (2000) argue that safety motivation mediates the relationship between safety climate and safety behavior. Probst and Brubaker (2001) have also provided empirical evidences to support the lagged mediating effect which safety motivation has on safety compliance behavior in the longitudinal study.

As it is documented that motivation will influence behavior in a positive way (Miller, 1988), individuals who are motivated to engage in safety behaviors should be more likely to carry out these behaviors. Given the causality between motivation and behaviors, it is presumed that the stronger the safety motivation that pilots have, the more they are willing to practice safety behavior. Furthermore, this study also hypothesizes that safety motivation mediates the respective causal relations between the targeted predictors and the two types of flight crew's safety behaviors. Data collected from the self-administrated questionnaire is employed to perform the analysis in order to present the empirical results.

2.5 CABIN CREW'S UPWARD SAFETY COMMUNICATION

As for cabin crew safety behaviors research, flight attendants' self-assessments of attitude toward upward safety communication has been applied to examine its effect on flight attendants safety behaviors and how it may mediate the causalities between the selected antecedents and those behaviors. Research on workplace safety and employees' safety behavior has shown that there are various approaches that organizations can attempt

to prevent the harmful consequences. In addition to safety policies and procedures, communication is also regarded an extremely important strategy to reduce workplace incidents and accidents (Kath et al., 2010). Safety communication assesses how free and open that employees feel to raise concerns and discuss safety related issues (Hofmann and Stetzer, 1998). While at work, cabin crew serves as the liaison between cockpit, cabin and ground. Communication thus has been long recognized to be essential to well perform the cabin duties. Smith et al. (1978) has indicated that open communication and frequent interactions between employees and managers are important determinants to lead to low accident rates. Hofmann and Morgeson (1999) also propose that upward safety communication has been shown to be related to adverse safety events. It is expected that the more cabin crew is willing to conduct upward safety communication, the better understanding shared between flight attendants and managers, and it leads to positive safety performance.

In the recent decade, safety communication has been prevalently adopted in the research of measuring safety climate in diverse industries (e.g. Cigularov et al., 2010; Lin et al., 2008; Mearns et al., 2003). Upward safety communication, in particular, refers to subordinates take initiative to express the concern or propose recommendation for safety related issues to their managers (Hofmann and Morgeson, 1999; Kath, et al., 2010). It not only reflects whether companies provide a certain kind of communication friendly working environment, but indicates how much employees value safety at work. With the contexture of teamwork, multi-functional roles and multi-tasks of which cabin crew is obligatory to perform on board (Chen and Chen, 2012b), communication has been recognized as one of the prominent job requirements to flight attendants. Working at the first line, flight attendants may easily observe the effects of company's policy on enhancing cabin safety, and collect the feedback from passengers. Airlines will be greatly beneficial if the precious

information offered by cabin crew is efficiently employed.

Cabin crew's willingness to conduct upward safety communication reflects the degree of their perceived importance of cabin safety performance, and how much effort they intend to devote. It is also asserted that employees' enthusiasm to conduct upward safety communication has positive impact on reducing occupational accidents and near-misses (Mearns et al., 1998; Probst, 2004). The above statements lead to the consentience that assessing cabin crew's attitude toward upward safety communication may help comprehend cabin safety performance at both individual and organizational levels.

At the individual level, prior studies have proposed that safety communication is considerably associated with employees' safety behavior (Cigularov et al., 2010; Griffin and Neal, 2000; Parker et al., 2001). Accordingly, it is assumed that flight attendants with stronger willingness to conduct upward safety communication, which means that their attitude toward taking initiative to express the opinions is positive, will be more certainly to comply with safety rules and participate with safety activities. The current research thus assume that cabin crew's positive attitude toward conducting upward safety communication may lead to their compliance and participation safety behaviors. Meanwhile, the mediating effects of upward safety communication, which may cause on the three causal sequences proposed in the conceptual model of cabin safety behavior, have also been examined to further extend the possible causal relationships between the three selected antecedents and flight attendants' safety behaviors.

2.6 SUMMARY

This chapter reviews the existed literature concerning the selected variables, which

are served as theoretical background to the conceptual models' development in the present paper for learning aircrew's safety behaviors. Aircrew's definitions, safety behavior, the designated antecedents presenting organizational, group and individual dimensions, and the two mediators are all illustrated in detail. Based on the arguments proposed by previous research, this study applies pilots' perceived airlines Safety Management System practice, fleet managers' morality leadership and self-efficacy as the indicators of flight crew's safety behaviors, with introducing the mediating effect of safety motivation. Regarding cabin crew's safety behaviors, concerning the specific job characteristic and requirements of cabin work, flight attendants' perceptions of department managers' benevolent leadership and personal core self-evaluations replace morality leadership and self-efficacy to represent the group and individual aspects' factors. In addition, the positive attitude of upward safety communication is assumed to lead to cabin crew's safety behaviors, and thus is employed to link the multi-factors and flight attendants' safety compliance and participation behaviors. The research design and methodology are presented in the following chapter, which aims at developing two integrated models to obtain the deeper and more thorough insights of flight and cabin crews' safety behaviors, respectively.

CHAPTER 3 RESEARCH DESIGN AND METHODOLOGY

Extended from the basic paradigm of S-O-R model, the two respective integrated models are constructed to analyze how flight crew and cabin crew may be directly or indirectly led to the safety behaviors. The focal antecedents and mediators in the two conceptual models are selected based on synthesizing the results of reviewing related literature, conducting in-depth interview with senior aircrew members, and ten-year working experience on board by the author as field observation. The two conceptual models linking multi-factors, mediators and aircrew's safety behaviors have been developed and illustrated in detail in this chapter. The models apply multi-factors to explore how the selected organizational, group and individual antecedents may enhance pilots and flight attendants safety behaviors, with the safety motivation and upward safety communication employed as mediators in the two respective studies. In this chapter, the conceptual models with hypotheses are presented first, followed by the introduction of methodology, including research populations, data collection, measures and data analysis technique.

3.1 THE CONCEPTUAL MODELS AND HYPOTHESES

Flight crew and cabin crew are both critical to the airlines safety performance, yet they carry out diverse work duties and specific responsibilities. The current study aims to develop two structural models for analyzing the causal relationships between multi-factors, which represent organization, group and individual aspects, and the safety behaviors performed by flight crew and cabin crew. To take the primary step of linking aircrew safety behavior and the three aspects' indicators, one factor represents each aspect is adopted to

build the conceptual models and empirically test the validation and fitness. Meanwhile, restricted to the limitations of collecting cross-level data in practice, the current research design is to analyze how pilots and flight attendants perceived diverse aspects' factors influence their self-appraised safety behaviors. In other words, all analyses are based on the data collected from aircrew members' personal perceptions of the selected variables.

The following sections will provide with two conceptual models and hypotheses in detail, respectively. The conceptual model representing flight crew safety behavior is indicated as Model A, while Model B presents the conceptual model of cabin crew safety behavior.

3.1.1 Model A: Flight Crew Safety Behavior

With the field observation of aircrew operation and reviewing sufficient literature focusing on safety behavior and aviation pilots, three factors representing organizational, group and individual aspects are selected to be the antecedents of pilot's safety behaviors, with safety motivation adopted as the mediator in the first conceptual model (stated as Model A). Pilots' perceived airlines Safety Management System practice indicates the organizational factor, while their perceptions of fleet managers' morality leadership and individual self-efficacy are applied to symbolize the group and individual factors. The conceptual model of flight crew's safety behavior is shown as Fig. 3.1.

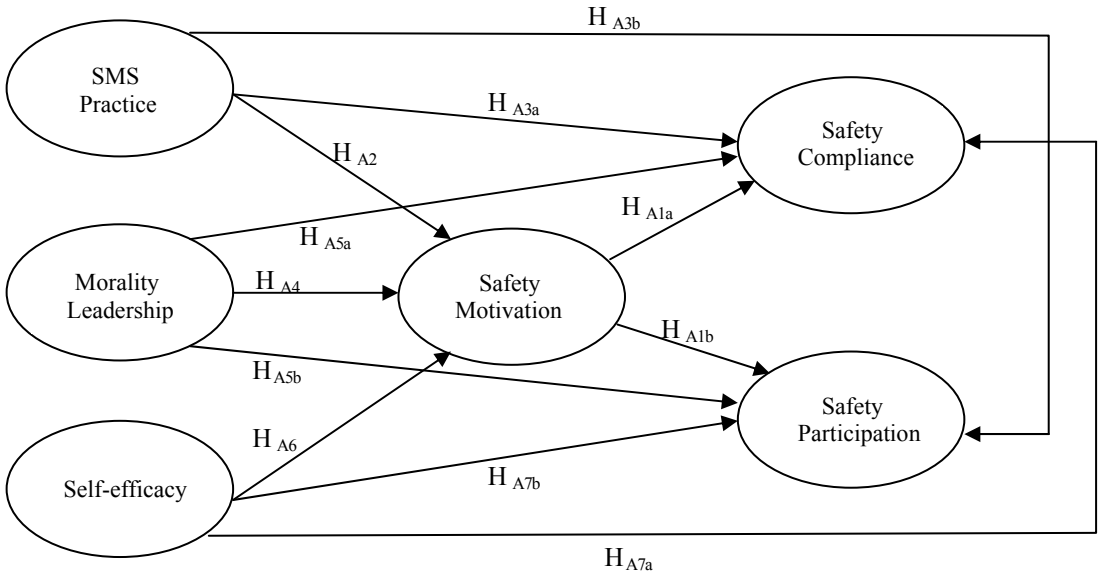


Figure 3.1 Model A: Conceptual Model of Fight Crew Safety Behaviors

As being the flight managers, pilots are expected not only to comply with the standard operation procedures, but take initiative to continually participate in the safety related activities and advocate safety concepts. Given on the causality between motivation and behavior, it is presumed that the stronger safety motivation the pilots hold, the more they are willing to practice the safety behaviors. Furthermore, this study also hypothesized that the safety motivation mediates the causal relations between the targeted predictors and the two types of pilots' safety behaviors. Motivation will lead to actions (Ames, 1990). Individuals who are motivated to engage in behaviors should be more possibly to carry out those behaviors, as it is documented that motivation will influence behavior in a positive way (Miller, 1988). Probst and Brubaker (2001) proposed that safety motivation has a lagged effect on safety behaviors. Neal and Griffin (2006) stated that employees with positive safety motivation will devote more efforts to enacting safety behaviors. In the current paper, the direct effect that safety motivation has on pilots' safety behaviors, and its mediating effect between the indicators and these behaviors are analyzed concurrently.

Hypothesis A1 deals with the positive relationship between pilots' safety motivation and safety behaviors, stated as following:

Hypothesis A1. Flight crew's safety motivation has positive effects on their a) safety compliance and b) safety participation.

An SMS program may be viewed as the embodiment of organizational safety climate since it consists of tangible implementation plans and criteria to evaluations. Pilots' assessment of airlines SMS practice demonstrates their perceptions on the effect of airline's endeavor to embody safety culture within the organization. One of the keys to achieving successful implementation of an SMS is to ensure that every employee participates in the system and fulfills their designated roles. Since "system" may represent the concept of an integrated set of processes which manages safety across intra-departmental boundaries (Galotti et al., 2006), how employees evaluate the companies' SMS practice is assumed to signal the effects of adopting such proactive safety model in practice in an organizational level. The result thus is appropriate to serve as the organizational aspects' factor to investigate its influence on pilots' safety behaviors. Accordingly, this study predicts that the better pilots perceived SMS practice within airlines, the stronger motivation they possess to perform safety behaviors. As the aforementioned assumption proposed that safety motivation mediates the relationship between airline SMS practice and pilots' safety behaviors, the direct and indirect effects of SMS practice on flight crew's safety behaviors are both examined by the empirical data. Hypotheses A2 and A3 are stated as follows.

Hypothesis A2. Flight crew's perception of airlines SMS practice has a positive effect on

their safety motivation.

Hypothesis A3. Flight crew's perception of airlines SMS practice has positive effects on their a) safety compliance and b) safety participation.

Based on the acquired specific licenses and aircraft type rating endorsement, commercial airlines pilots are grouped into designated fleets to conduct the flight duties (Clarke et al., 1996). The fleet managers, who are selected from well-performed senior captains, account for maintaining the fleet operational standards and procedures, pilots' training standards and working discipline. The leadership enacted by fleet managers is believed to have the strength toward influencing pilots' behaviors, as the sufficient evidences support the causality between leadership and subordinate's performance (Barling et al., 2002; Jong and Hartog, 2007). How fleet managers' morality leadership style impacts pilots' motivation to perform safety behaviors may provide the crucial insights into the underlying theme linking leadership and employees' behaviors.

The paternalistic leadership literature suggests that morality leadership will likely motivate subordinates to put more effort into work and go above and beyond for their leaders (Colquitt et al., 2007). Consistent with the suggestions proposed by prior research that morality leadership styles are positively related to employees' organizational behavior (Cheng et al., 2002; Chou et al., 2005), the current study hypothesizes that airlines fleet manager's morality leadership style may motivate pilots to conduct safety behaviors, stated as hypotheses 4 and 5. The mediating effect which safety motivation may have on this causal sequence will also be examined.

Hypothesis A4. Fleet manager's morality leadership has a positive effect on flight crew's safety motivation.

Hypothesis A5. Fleet manager's morality leadership has a positive effect on flight crew's a) safety compliance and b) safety participation.

Correspondingly, personal attributes have been emphasized with the influences to the pilots' unsafe behaviors in the previous research (Ji et al., 2011). In the present study, self-efficacy is selected to represent the individual aspect factor due to its consistent predictive power of behavior and behavior change (Graham and Weiner, 1995). There is no doubt that commercial aviation pilots undertake tremendous burdens psychologically and physically either at work or for abidingly qualifying for the job requirements. As efficacious people hold the faith in their own capabilities to achieve the goals, pilots with higher level's self-efficacy are expected to confront the challenge and overcome difficulties to improve proficiency which is expected for this position. This paper thus observes whether self-efficacy may trigger flight crew's safety motivation and generate their safety behaviors to expand the understanding of the causality relationship in the individual level. The hypotheses have been stated as follows. Followed by the hypotheses test, the mediating effect of safety motivation on flight crew's self-efficacy and safety behaviors is examined.

Hypothesis A6. Flight crew's self-efficacy has a positive effect on their safety motivation.

HypothesisA7. Flight crew's self-efficacy has a positive effect on their a) safety compliance and b) safety participation.

3.1.2 Model B: Cabin Crew Safety Behavior

To gain thorough comprehension of cabin crew's safety behavior, the conceptual model with multi-factors is developed based on the research results of aforementioned

literature and in-depth interview with senior flight attendants. Coincide with the model development process of flight crew's safety behavior, cabin crew's perception of airlines' SMS practice is selected to account for organizational indicator in Model B, while their perception of department managers' benevolent leadership is used as the group aspect's predictor. To accent the required capabilities of handling multi-tasks at work for flight attendants, the individual core self-evaluations (CSE) assessment, which consists of self-esteem, locus of control, neuroticism (or emotional stability), and generalized self-efficacy (Judge et al., 1997), is employed as the individual aspect factor. In addition, concerning the significance of communication for well performing cabin duty, flight attendants' upward safety communication is subsumed in the model to be the mediator. The conceptual model of cabin crew's safety behaviors is presented as Figure 3.2, followed by the depiction of hypotheses.

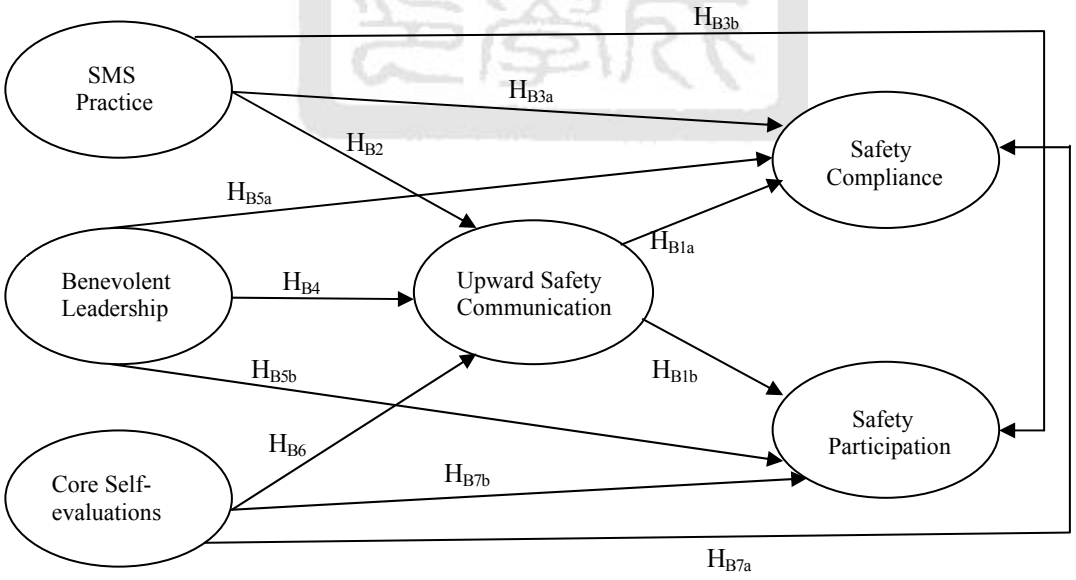


Figure 3.2 Model B: Conceptual Model of Cabin Crew Safety Behavior

Communication is critical to the success of cabin work, since flight attendants are required to perform as the liaison between cockpit and cabin, cabin and ground, also passengers and airlines. The Flight Attendant Manual Standard, issued by Transport Canada (1996), indicates that it is the cabin crew's responsibility to communicate any on-board safety concerns they may have or that may be communicated to them by a passenger to the captain. This statement reveals that performing upward safety communication is one of the cabin crew's obligations. Hufmann and Morgeson (1999) also propose that upward safety communication has been shown to be related to adverse safety events. It is expected that the more cabin crew is willing to conduct upward safety communication, the better understanding shared between flight attendants and managers, and it leads to positive safety performance. Since safety communication has been proved to be considerably associated with employees' safety behavior (Cigularov et al., 2010; Parker et al., 2001), it is expected that cabin crew's attitude toward upward safety communication will have a positive effect on their safety behaviors , the hypothesis is addressed as below.

Hypothesis B1. Cabin crew's upward safety communication has a positive effect on their a) safety compliance and b) safety participation.

Consistent with the argument addressed in the conceptual Model A, regarding the effects which employees' perceived airlines SMS practice may cause, the hypothetical links between the organizational aspect factor, namely flight attendants' perceptions of airline SMS practice, and cabin crew's upward safety communication and safety behaviors are illustrated as Hypotheses B2 and B3. The mediating effect which upward safety communication may have on this causal sequence will also be examined.

Hypothesis B2. Cabin crew's perception of airlines SMS practice has a positive effect on their upward safety communication attitude.

Hypothesis B3. Cabin crew's perception of airlines SMS practice has positive effects on their a) safety compliance and b) safety participation.

As for the group aspect's factor, cabin crew's perception of department managers' benevolent leadership is expected to positively impact flight attendants' attitude toward upward safety communication and safety behaviors. Benevolent leadership symbolizes the paternalistic management style rooted in Chinese cultural background. Previous research demonstrated the positive causalities between benevolent leadership and a variety of favorable work outcomes, such as job performance, organizational commitment and citizenship behavior (Erben and Gunerser, 2008; Farh et al., 2008). Karakas and Sarigollu (2011) also suggest that benevolent leadership model may provide leaders with a fresh perspective on addressing and solving complex ethical, spiritual, transformational problems and social challenges in the corporate world. Whether department managers' benevolent leadership may lead to flight attendants' positive perception toward upward safety communication and safety behaviors are examined in the current study. Meanwhile, the mediating effect of upward safety communication on department manager's benevolent leadership and cabin crew's safety behaviors are also examined. The empirical results are believed to extend the applications of paternalistic leadership academically and in practice. The related hypotheses are illustrated as below.

Hypothesis B4. Department manager's benevolent leadership has a positive effect on cabin crew's upward safety communication.

Hypothesis B5. Department manager's benevolent leadership has a positive effect on cabin crew's a) safety compliance and b) safety participation.

Regarding the individual aspect's factor, flight attendants' perception of core self-evaluations (CSE) is targeted. People with positive core self-evaluations tend to express strong locus of control, elevated self-esteem and self-efficacy, also stable emotional status (Judge and Hurst, 2007). All above are essential to well perform cabin work, which is highly demanding emotionally, physically and mentally. The current study thus reviews the related literature confirming the linkage between CSE and employees' job performance to form the fundament of theoretical bases and examine the expected effect which CSE has on cabin crew's upward safety communication and behaviors. The mediating effect of upward safety communication on this causal sequence is been tested. The associated hypotheses are as follows.

Hypothesis B6. Cabin crew's CSE has a positive effect on their upward safety communication.

Hypothesis B7. Cabin crew's CSE has a positive effect on their a) safety compliance and b) safety participation.

3.2 RESEARCH POPULATIONS AND DATA COLLECTION

To develop the conceptual models for predicting aircrew's safety behaviors, two studies were conducted respectively. Flight crew's safety behavior research was first carried out, followed by the cabin crew's safety behavior research. The research populations and data collection of Model A and Model B are illustrated below.

3.2.1 Model A: Flight Crew

In model A, the targeted study population is the flight crew members who work for

Taiwanese international airlines. Due to their changing work schedule, the paper-based survey was initially distributed through each airline's internal contact. Questionnaires with sealable stamped addressed envelopes were either deposited in the individual mailbox or distributed on board an aircraft. Data were first collected during the period of five months from early August to the end of December, 2011. A total of 420 surveys were distributed upon two time frames. At the first attempt, 300 surveys were mailed out and 163 usable samples returned. To increase the sample size, 120 surveys were sent to the companies with low response rate at the first attempt in February, 2012. A special notice was sent to the internal contact to prevent the overlap of the respondents. Ninety-two samples were returned and among which 76 ones were effective. Totally 239 usable samples were collected, representing an acceptable response rate of 57 %.

3.2.2 Model B: Cabin Crew

The targeted study population in model B is the local cabin crew members who work for international airlines in Taiwan. Considering the shifted working schedule of flight attendants, questionnaires with sealable stamped addressed envelopes were either deposited in the individual mailbox or distributed on board an aircraft. Data collection was performed during the five-month period from early April to August, 2012. A total of 450 surveys were distributed. Three hundred and nine samples were returned, among which 296 ones were effective, representing an acceptable response rate of 66 %.

3.3 QUESTIONNAIRE DESIGN

Questionnaires applied to survey flight and cabin crews' safety behaviors are both made of two parts. The first part is for the scales to obtain the measures of the variables.

The second part is for collecting the information regarding the respondents' demographics information.

3.3.1 Measures

The scales used to obtain the measures of the variables are described below. All items were rated on a seven-point Likert scale ranging from 1= *strongly disagree* to 7= *strongly agree.*

3.3.1.1 Safety Management System Practice

A customized SMS practice evaluation scale (Chen and Chen, 2012a) for the Taiwanese airline industry has been adopted to collect aircrew's perceptions of airlines SMS practice. The scale was developed by applying Schwab's three-stage scale development procedures (1980). First, for the item development stage, scale items were initially generated from the SMS documentation issued by major aviation organizations and authorities worldwide and subsequently revised based on the comments made by eight local aviation safety experts in in-depth interviews. Secondly, the exploratory factor analysis was employed with the aim of defining the underlying structure among the variables to produce a more concise version of the evaluation scale. Finally, confirmatory factor analysis was undertaken to further quantify the goodness of fit of the resulting factor structure.

The original survey questions were designed to identify the important aspects and items for developing an effective SMS within airline companies. Rather than judging how important the items represent, aircrews were asked to identify the individual perceptions of company's SMS practice in this study. Respondents select the number which denotes their perceptions regarding the degree of agreement. In the research of pilots' safety behaviors,

the SMS evaluation scale consists of five constructs with 23 items (as shown in Table 3.1). The five constructs include: Safety Management Policy, Executive Management Commitment, Emergency Preparedness and Response Plan, Documentation and Comments, Safety Promotion and Training.

The scale has later been condensed to the brief version of two constructs with 17 items, by employing exploratory factor analysis technique with the quantitative data collected from pilots' responses. The condensed version has been adopted in cabin crew's safety behavior research. The two constructs were named Policy and Practice. Sample items include: "The internal reporting channel is highly accessible in the company." "The top management participates in SMS related activities." "Employees periodically take training programs related to emergency preparedness and response plans." "Managers order clear commands for SMS operations." and "The company holds SMS promotion activities regularly"

Table 3.1 The Full Version of the SMS Evaluation Scale

Constructs	Items
Safety Management Policy	1. The company continuously improves the SMS practice. 2. The company develops precise standard to monitor and evaluate the SMS practice. 3. The company's internal reporting channel is highly accessible.
Executive Management Commitment	1. The top management participates in SMS related activities. 2. The management handles safety related issues following the principles of fairness and justice. 3. The top management has clearly stated its determination to execute SMS, even in periods when the company is not growing. 4. The top management declares its commitment to safety in formal documents.
Emergency Preparedness and Response Plan	1. Employees are acquainted with the emergency preparedness procedures and response plans. 2. Employees periodically take training programs related to emergency preparedness and response plans. 3. The company periodically runs drills to practice the emergency preparedness procedures and response plans. 4. The company establishes emergency preparedness and response plans with clear procedures and based on the principle of individual responsibility.
Documentation and Commands	1. Managers order clear commands for SMS operations. 2. The contents of the SMS manual are readily understood. 3. The intranet system can precisely save, secure and trace the information. 4. An intranet system is used as the platform to share SMS related information. 5. SMS related documents are preserved and continuously updated in a standardized format. 6. The company establishes a simple and unified standard for safety behavior.
Safety Promotion and Training	1. Employees upgrade their self-managed abilities to conduct safety behavior through the training programs. 2. Employees learn comprehensive concepts related to SMS through the training programs. 3. The company continuously provides employees with safety related training programs. 4. Employees know the correct way to execute SMS through the training programs. 5. The company provides diverse training programs (e.g. lectures, workshops, and group activities). 6. The company holds SMS promotion activities regularly.

3.3.1.2 Morality Leadership and Benevolent Leadership

The scale of morality leadership and benevolent leadership adopted the measure developed by Cheng et al. (2000). This scale has demonstrated consistent and good psychometric properties in several studies (e.g., Chen et al., 2011). Each scale contains five items. Table 3.2 presents the scale items.

Table 3.2 The Scale Items of Morality and Benevolent Leadership

Constructs	Items	Source
Morality Leadership	1. My supervisor is an upright and honest person; he/she never promotes his/her private interests under the guise of serving the public. 2. My supervisor treats his staff very fair. 3. My supervisor does not use personal relationships or back-door practices to obtain illicit personal gains. 4. My supervisor sets himself/ herself a good role model to follow. 5. My supervisor always practices what he preaches.	Cheng et al. (2000)
Benevolent Leadership	1. Beyond work relations, my supervisor expresses concern about my daily life. 2. My supervisor ordinarily shows a kind concern for my comfort. 3. My supervisor will help me when I'm in an emergency. 4. My supervisor takes very thoughtful care of subordinates who have spent a long time with him/her. 5. My supervisor takes good care of my family members as well.	

3.3.1.3 Self Efficacy

The Generalized Self-Efficacy Scale developed by Schwarzer and Jerusalem (1995) was applied to assess pilots' optimistic self-beliefs to cope with a variety of difficult

challenges in life. The full scale with ten items was used and the detailed scale items are presented in Table 3.3.

Table 3.3 The Scale Items of Self-efficacy

Constructs	Items	Source
Self-efficacy	1. I can always manage to solve difficult problem if I try hard enough. 2. If someone opposes me, I can find the means and ways to get what I want. 3. It is easy for me to stick to my aims and accomplish my goals. 4. I am confident that I could deal efficiently with unexpected events. 5. Thanks to my resourcefulness, I know how to handle unforeseen situations. 6. I can solve most problems if I invest the necessary effort. 7. I can remain calm when facing difficulties because I can rely on my coping abilities. 8. When I am confronted with a problem, I can usually find several solutions. 9. If I am in trouble, I can usually think of a solution. 10. I can usually handle whatever comes my way.	Schwarzer and Jerusale (1995)

3.3.1.4 Core Self-evaluations

The 12-items Core Self-evaluations Scale (CSES) developed by Judge et al. (2003) was employed to measure cabin crew's CSE. The CSES measures a single factor that is composed of self-esteem, locus of control, generalized self-efficacy, and emotional stability. Half the items are stated in reversed illustration. Table 3.4 shows the detailed scale items.

Table 3.4 The Scale Items of Core Self-evaluations

Constructs	Items	Source
Core Self-evaluations	1. I am confident I get the success I deserve in life. 2. Sometimes I feel depressed. (R) 3. When I try, I generally succeed. 4. Sometimes when I fail I feel worthless. (R) 5. I complete tasks successfully. 6. Sometimes, I do not feel in control of my work. (R) 7. Overall, I am satisfied with myself. 8. I am filled with doubts about my competence. (R) 9. I determine what will happen in my life. 10. I do not feel in control of my success in my career. (R) 11. I am capable of coping with most of my problems. 12. There are times when things look pretty bleak and hopeless to me. (R)	Judge et al. (2003)

Note. (R) denotes reversed item and has been reverse coded.

3.3.1.5 Safety Motivation

Safety motivation was assessed with three items from Neal and Griffin (2006). It measured the degree to which pilots regard safety as an important part of their career life. The detailed information of the scale is presented by Table 3.5.

Table 3.5 The Scale Items of Safety Motivation

Constructs	Items	Source
Safety Motivation	1. I feel that it is worthwhile to put in effort to maintain or improve my personal safety. 2. I feel that it is important to maintain safety at all times. 3. I believe that it is important to reduce the risk of accidents and incidents in the workplace.	Neal and Griffin (2006)

3.3.1.6 Upward Safety Communication

Five items from a scale reported by Hofmann and Morgeson (1999) were utilized to measure cabin crew's willingness of conducting upward safety communication. To specifically identify the intention of cabin crew's specific communication behavior, one item was added to the questionnaire, which asks "I'd like to propose suggestions regarding safety issues." The detailed scale information is provided in Table 3.6.

Table 3.6 The Scale Items of Upward Safety Communication

Constructs	Items	Source
Upward Safety Communication	1. I'd like to propose suggestions regarding safety issues. 2. I feel comfortable discussing safety behavior with my supervisor. 3. I try to avoid talking about safety issues with my supervisor. (R) 4. I feel that my supervisor openly accepts ideas for improving safety. 5. I am reluctant to discuss safety-related problems with my supervisor. (R) 6. I feel that my supervisor encourages open communication about safety.	Hofman and Morgeson, (1999)

Note. (R) denotes reversed item and has been reverse coded.

3.3.1.7 Safety Behavior

Safety behavior consisting of two components, safety compliance and safety participation (also identified as proactive safety behavior), was adopted from Neal and Griffin (2006). Safety compliance used three items to evaluate the core tasks that aircrew has to accomplish to maintain flight safety. To precisely evaluate aircrew's safety compliance and participation behaviors, some items were reworded to correspond with the specific job context of pilots and flight attendants. The scale items for pilots' safety

behavior are shown on Table 3.7. Table 3.8 is for the scale items of cabin crew's safety behavior.

Table 3.7 The Scale Items of Flight Crew's Safety Behavior

Constructs	Items	Source
Safety Compliance	1. I pay full attention to the pre-flight briefing to collect sufficient data for every flight. 2. I use the correct safety procedures for carrying out my job. 3. I ensure the highest level of safety when I carry out my job.	Neal and Griffin (2006)
Safety Participation	1. I promote the safety program within the organization. 2. I put in extra effort to improve the flight safety. 3. I voluntarily carry out tasks or activities that help to improve flight safety.	

Table 3.8 The Scale Items of Cabin Crew's Safety Behavior

Constructs	Items	Source
Safety Compliance	1. During ground check, I will make sure all emergency equipment has been well-loaded. 2. I use the correct safety procedures for carrying out my job. 3. I ensure the highest level of safety when I carry out my job on board.	Neal and Griffin (2006)
Safety Participation	1. I promote the safety program within the organization. 2. I put in extra effort to improve the safety on board. 3. I voluntarily carry out tasks or activities that help improve cabin safety.	

3.3.1.8 Demographic Variables

Based on the specific job characters of flight and cabin crews, the information of respondents' demographics was collected. The demographic questions in flight crew's

survey contain gender, age, years of tenure, total flight hours, position, marital status and training background. The ones in cabin crew's research include gender, age, years of tenure, monthly salary, position, marital status, numbers of children and the average flight hours within the last three months. The questionnaire was anonymous and all replies were asserted to be held securely and confidentially.

3.4 DATA ANALYSIS METHODS

Seven data analysis methods applied in the research are introduced in detail in the following sections.

3.4.1 Descriptive Statistics

Descriptive statistics is the technique of quantitatively describing the main aspects of a collection of data (Mann, 1995). It provides simple summaries about the sample and the observations that have been made. In the current paper, the demographic and observed variables of collected data from respondents' survey will be first presented in frequency, mean, standard deviation and percentage by descriptive statistics.

3.4.2 Reliability Analysis

Reliability refers to a variable or a set of indicators of a latent construct being internally consistent in their measurements (Hair et al., 2009). To assess the reliability of the measures, Cronbach's α coefficient is applied to evaluate the internal consistency of each construct, since it is most widely used. Cronbach's alpha ranges from 0 to 1, with value of 0.7 being considered a satisfactory level in basic research (Iacobucci and Churchill, 2010).

3.4.3 Exploratory Factor Analysis (EFA)

Exploratory factor analysis aims to discover the nature of the constructs affecting a set of responses. It is a technique to examine the underlying structure or relationships for a large number of variables, and to determine whether the information can be condensed or summarized in a smaller set of factors or components, with a minimum loss of information (Hair et al., 2009). To search for and define the fundamental constructs presumed to underlie the original variables, four issues are critical to the practice of exploratory factor analysis, namely specifying the unit of analysis, achieving data summarization and/or data reduction, variable selection, and using factor analysis results with other multivariate techniques (Hair et al., 2009).

EFA is a broadly utilized and applied statistical technique in the social sciences research. Within the last decade, EFA was employed in numerous studies for widely diverse applications (e.g. Chen and Tsai, 2007; Majors and Sedlacek, 2001; Watson et al., 2005).

To perform the exploratory factor analysis, the following steps are recommended to proceed (Hair et al., 2009). At first, ensure the sufficient correlations within data matrix. The Barlett test of Sphericity and Kaiser-Meyer-Olin test are both commonly applied to test correlations among the variables. Secondly, select factor extraction and rotation methods to manipulate or adjust the factor axes to achieve a simpler and pragmatically more meaningful factor solution. Next, determine the number of factors by presetting the critical values. The most widely adopted criteria are eigenvalue and a scree plot (suggested value greater than one). The variables are retained only if they have factor loadings greater than 0.5 in one single factor.

In the current study, the maximum likelihood extraction with VARIMAX rotation has

been applied to extract the underlined factors representing Safety Management System practice scale. For pilots' safety behavior research, the principal component analysis with VARIMAX rotation is applied to reduce the size of the original SMS practice scale.

3.4.4 Correlation Analysis

Correlation measures the association between two variables. It is a useful technique to identify a predictive relationship that can be utilized in practice. The most broadly applied measure to indicate the degree of dependence between two quantities is Pearson product-moment correlation coefficient (typically denoted by r). The value of r is set between -1 and +1 (Rodgers and Nicewander, 1988). The advantage of using Pearson's coefficient of correlation is that its mathematical and statistical properties have been studied in much detail, also the tables and algorithms for testing the statistical significance of r being available (Hunter and Schmidt, 1990; Raju and Brand, 2003). The current study thus employs it to indicate the correlation among the selected variables and the correlation matrix is used as the input for conducting the further analyses.

3.4.5 Confirmatory Factor Analysis (CFA)

CFA involves "the specification and estimation of one or more putative models of factor structure, each of which proposes a set of latent variables (factors) to account for covariances among a set of observed variables" (Doll et al., 1995, p. 178). CFA was first developed by Jöreskog (1969) and applied to test whether the data fit a hypothesized measurement model, which is based on theory or prior analytic research. The key advantage of CFA is to allow researchers for analytically testing a conceptually grounded theory which explains how different measured items represent important psychological, sociological, or business measures. When CFA results are combined with construct validity

tests, researchers can acquire a better understanding of the quality of the measures (Hair et al., 2009).

CFA is commonly employed as the first step to assess the proposed measurement model in a structural equation model, for its main purpose of confirming with the construct validity. The construct validity is the extent to which a set of measured variables actually represent the theoretical latent construct they are designed to measure (Hair et al., 2009). The technique of convergent validity and discriminant validity are frequently applied to indicate the results of construct validity. Convergent validity requires indicators of a definite construct converging or sharing a high proportion of variance in common. According to Hair et al. (2009), the convergent validity has to be supported by item reliability, construct reliability (CR) and average variance extracted (AVE). All factor loadings and AVE should be of 0.5 or higher. CR should exceed the critical value of 0.6, as suggested by Fornell and Larcker (1981). The results data must be estimated statistically significant, which is shown by t – values being greater than 1.96 or smaller than -1.96 (Segars, 1997). The construct reliability is computed by the formula below:

$$CR = (\sum \lambda)^2 / [(\sum \lambda)^2 + \sum (\theta)]$$

where $\sum$ = summation of the indicators of the latent variables, λ = indicator loadings, θ = indicator error variances.

The average variance extracted is computed by the formula below:

$$AVE = (\sum \lambda^2) / [\sum \lambda^2 + \sum (\theta)]$$

Discriminant validity identifies a construct which is absolutely distinct from other constructs. It is assessed by comparing the construct correlations with the square root of

the average variance extracted (Fornell and Larcker, 1981). The square root of the average variance extracted for each construct should be greater than the levels of the correlations involving the construct.

Confirmatory Factor Analysis is a multivariate tool that computes a predicted covariance matrix using the equations that represent the theory tested. It is requested to apply multiple fit statistics index to help understand how well a model truly fits. Chi-square (χ^2) goodness-of-fit statistic, degrees of freedom, χ^2/df, one absolute fit index (e.g. GFI) and one badness-of-fit indicator such as RMSEA are recommended to be reported (Hair et al., 2009).

In addition, since all data are self-reported and collected through the same questionnaire during the same period of time with a cross-sectional research design, to recognize whether common method variance (CMV) causes systematic measurement error and possibly inflates or deflates the relationships observed among constructs, Harman's single factor test and confirmatory factor analysis are performed to test the presence of the common method effect (Podsakoff et al., 2003). Furthermore, a secondary analysis with competing model, which contains all the indicators and latents of the conceptual model except the indicators are double loaded onto a method factor, is applied to compare with the conceptual model to further attest the effects of common method variance (Moorman and Blakely, 1995; Podsakoff et al., 2003).

3.4.6 Structural Equation Modeling (SEM)

SEM is a multivariate technique combing aspects of factor analysis and multiple regressions that enables the researchers to simultaneously assess a series of interrelated dependence relationships among the measured variables and latent constructs as well as

between multiple latent constructs (Hair et al., 2009). Anderson and Gerbing (1988) suggest a two-step approach which first estimates the measurement model by conducting CFA and followed by structural model's estimation and modification. In SEM, multiple fit statistics index is also dictated to evaluate the overall structural model fit. Besides, the hypothesized dependence relationships are examined to confirm whether the hypothetical links in the conceptual model are statistically significant and in the predicted direction, denoted by the path coefficients. Table 3.9 presents the goodness-of-fit indices and the corresponding criteria suggested by Hair et al. (2006).

Table 3.9 Goodness-of-fit Indices and the Corresponding Criteria

	Fit indices	Criteria
Absolute Fit Measures	χ^2 value	Non-significant, the smaller the better
	χ^2/df	< 3
	Root mean square error of approximation (RMSEA)	<0.08
	Root mean square residual (RMR)	<0.08
	Goodness of fit (GFI)	>0.8
	Adjusted goodness of fit (AGFI)	>0.8
Incremental Fit Measures	Normed fit index (NFI)	>0.9
	Comparative fit index (CFI)	>0.9
Parsimonious Fit Measures	Parsimony goodness-of-fit (PGFI)	<0.5
	Parsimony normed fit index (PNFI)	<0.5

Source: Hair et al. (2006). Multivariate Data Analysis with Reading. 6th Edition. Prentice Hall International, New Jersey: Upper Saddle River.

3.4.7 Mediating Effect Test

In general, a mediator is a given variable which is in a causal sequence between the predictor and the criterion (MacKinnon et al., 2000). The relation paradigm may be illustrated as Fig. 3.3. A variable functions as a mediator when it meets the following conditions: (a) variations in levels of the independent variables significantly account for

variations in the presumed mediator (i.e., Path a), (b) variations in the mediator significantly account for variations in the dependent variable (i.e., Path b), and (c) when Paths a and b are controlled, a previously significant relation between the independent and dependent variables is significantly decreased (Baron and Kenny, 1986, p. 1176).

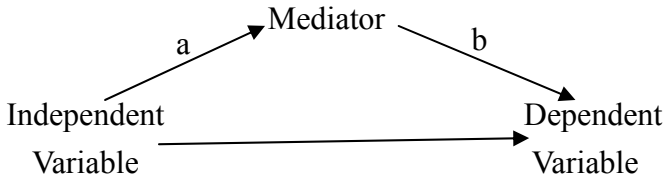


Fig. 3.3 The Mediation Diagram

Both regression analysis and SEM technique are commonly used to test the mediation effect. As for regression analysis, Sobel (1982) proposed an approximate significance test for the indirect effect of the independent variable on the dependent variable via the mediator, which has been widely applied as an interactive calculation tool for mediation tests. However, the use of multiple regression to estimate a meditational model requires the two following assumptions: a) no measurement error in the mediator, and b) the dependent variable does not cause the mediator (Baron and Kenny, 1986). Since the mediator often is an internal, psychological variable, it is expected to be measured with error. SEM approach thus is more appropriate to employ in the present study to test the mediating effects of pilots' safety motivation and flight attendants' upward safety communication, for its major advantages including: First, complications of measurement error and correlated measurement error are incorporated directly in the model (Hoyle and Smith, 1994). Second, SEM is specifically useful when multiple indicators for the latent variables are under investigation (Holmbeck, 1997).

Another more advanced approach is to bootstrap the sampling distribution of *ab* and

obtain a confidence interval with the empirically derived bootstrapped sampling distribution (see, e.g., Efron and Tibshirani, 1993; Mooney and Duval, 1993). "Bootstrapping is a nonparametric approach to effect-size estimation and hypothesis testing that makes no assumptions about the shape of the distributions of the variables or the sampling distribution of the statistic" (Preacher and Hayes, 2004, p. 721). Bootstrapping generates an empirical representation of the sampling distribution of the indirect effect by treating the obtained sample of size n as a representation of the population in miniature, one that is repeatedly resampled during analysis as a means of imitating the original sampling process (typically repeated for 5,000 items). Upon completion, the endpoints can be adjusted to yield a bias corrected or a bias-corrected and accelerated confidence interval. Regardless of which is used, if zero is not between the lower and upper bound, analysts can claim that the indirect effect is not zero with a certain confidence (usually preset at 95%) (Hayes, 2009). Simulation research indicates that bootstrapping is one of the more valid and powerful methods for testing mediating effects (Williams and Mackinnon, 2008), and with the advantage of it preset in some popular statistic software programs (e.g. SPSS, AMOS), bootstrap is adopted to test the mediating effects of pilots' safety motivation and flight attendants' upward safety communication in the current paper.

3.5 SUMMARY

This chapter addresses two conceptual models to illustrate the causal linkages and hypotheses among selected predictors, mediators and aircrew's safety behaviors. The detailed information regarding research populations, data collected mechanism, questionnaire design and data analysis methods are provided. The data analysis methods

used in the current paper, including descriptive statistics, Cronbach's coefficient, correlation analysis, EFA, CFA, SEM and mediating effect test, were carried out by applying the statistics software SPSS 18.0 for Windows and LISREL 8.52 computer program (Jöreskog and Sörbom**,** 2002).

CHAPTER 4 DATA ANALYSES AND DISCUSSION

In the previous chapter, the two respective conceptual models demonstrating the hypothetical linkages of flight and cabin crews' safety behaviors have been developed. This chapter aims to illustrate the empirical results by applying the aforementioned analysis methods to analyze the data collected from the respondents' questionnaires. The section of flight crew's safety behavior has been first conducted, followed by the section of cabin crew's safety behaviors.

4.1 FLIGHT CREW SAFETY BEHAVIOR

How flight crew's safety behaviors are influenced by the pilots' perceptions of airlines SMS practice, fleet managers' morality leadership and pilots' self-efficacy is first analyzed. As suggested by Armstrong and Overton (1977), non-response bias was tested by conducting an independent sample *t* test to analyze whether there were any significant differences between the two sample groups (163 collected in the first timeframe as group one and 76 in the second collection as group two). The results indicated that no significant differences existed between two groups in any of the constructs, verifying the representativeness of the collected samples. Totally 239 usable samples out of 420 mailing out questionnaires were collected, representing an acceptable response rate of 57 %.

4.1.1 Demographic Characteristics of Pilot Respondents

The respondents' profile is presented in Table 4.1. The samples are mostly male (95%), and their age was mostly from 30 to 39 (48.9%). Respondents' years of tenure in their current company mainly fell into the range of 1 to 10 years (60.2%). 59% of the

samples are ranked as first officers, 32.2% of the samples have a position as captain. 23.4% of the respondents have total flight hours between 10, 000 and 15,000 hours, with 17.6% between 3,000 and 5,000 hours. The training background is indicated as 23.8% of having self-paid Commercial Pilot License (CPL) training, 33% company-paid CPL training, 23% air-force training and 20% are foreign pilots.

Table 4.1 The Respondents Profile of Flight Crew (N = 239)

Demographic characteristics	Frequency	Percentage (%)
Gender		
Male	227	95.0
Female	12	5.0
Age		
25-29	6	2.5
30-34	73	30.5
35-39	44	18.4
40-49	88	36.9
50-59	28	11.7
Tenures of Year in Current Company		
1-5 years	75	31.3
6-10 years	69	28.9
11-15 years	50	20.9
16-20 years	31	13.0
21-25 years	10	4.2
26-30 years	4	1.7
Total Flight Hours		
0-1000 hours	18	7.5
1001-2000 hours	18	7.5
2001-3000 hours	32	13.4
3001-5000 hours	42	17.6
5001-7000 hours	30	12.6
7001-10000 hours	31	13.0
10001-15000 hours	56	23.4
more than 15000 hours	12	5.0
Position		
Check Pilot	6	2.5
Instructor Pilot	15	6.3
Captain	77	32.2
First Officer	141	59.0
Marital Status		
Married	182	76.2
Single	57	23.8
Training Background		
Self-paid CPL	57	23.8
Company-paid CPL	79	33.0
Air-force	55	23.0
Foreign pilot	48	20.2

Note. CPL stands for Commercial Pilot License.

4.1.2 Descriptive Statistics Results

The detailed information regarding means and standard deviations (S.D.) of the observable items is presented in Table 4.2. Pilots perceive moderately high level of airlines SMS practice, fleet manager morality leadership and self-efficacy, since the mean scores are between 4.5 and 5.6. In average, pilots hold strong safety motivation and are willing to conduct safety compliance behavior.

Table 4.2 Descriptive Statistics Results of Model A

Constructs	Items	Mean	S.D.
SMS Practice	1. Continuously improves the SMS practice.	5.18	1.34
	2. Precise standard of the SMS practice.	4.92	1.35
	3. Internal reporting channel is highly accessible.	5.20	1.26
	4. Top management participates.	4.87	1.37
	5. Following the principles of fairness and justice.	4.98	1.49
	6. Clearly stated its determination to execute SMS.	5.60	1.50
	7. Declares commitment in formal documents.	5.22	1.31
	8. Employees are acquainted with plans.	5.09	1.32
	9. Employees periodically take training programs.	5.51	1.21
	10. Company periodically runs drills to practice plans.	5.15	1.23
	11. Establishes emergency preparedness and response plans.	5.18	1.30
	12. Managers order clear commands.	4.77	1.35
	13. The contents of the SMS manual are readily understood.	4.72	1.31
	14. Intranet system can precisely handle the information.	4.84	1.30
	15. Intranet system used as the platform to share information.	4.84	1.35
	16. Documents are preserved and continuously updated.	4.88	1.28
	17. Establishes simple and unified standard.	4.97	1.31
	18. Employees upgrade abilities through training programs.	5.04	1.23
	19. Employees learn concepts through training.	4.88	1.26
	20. Company continuously provides training programs.	5.08	1.18
	21. Employees know way to execute SMS through training.	4.90	1.23
	22. Company provides diverse training programs.	4.56	1.41
	23. The company holds SMS promotion activities regularly.	4.91	1.29
Morality Leadership	1. Supervisor is an upright and honest person.	4.95	1.46
	2. Supervisor treats staff very fair.	5.10	1.46
	3. Supervisor does not obtain illicit personal gains.	4.99	1.45
	4. Supervisor is a good role model to follow.	4.94	1.55
	5. Supervisor always practices what he preaches.	5.32	1.45

Table 4.2 Descriptive Statistics Results of Model A (N = 239) (continued)

Constructs	Items	Mean	S.D.
Self – efficacy	1. I can solve difficult problems if try hard enough.	5.50	1.06
	2. I can find the means and ways to get what I want.	4.52	1.29
	3. It is easy to stick to my aims and accomplish goals.	4.67	1.32
	4. I am confident to deal efficiently with unexpected events.	5.43	1.06
	5. I know how to handle unforeseen situations.	5.26	1.04
	6. I can solve most problems if I invest the necessary effort.	5.61	0.92
	7. I can remain calm when facing difficulties.	5.69	0.82
	8. I can find solutions when confronted with a problem.	5.63	0.84
	9. If I am in trouble, I can usually think of a solution.	5.67	0.87
	10. I can usually handle whatever comes my way.	5.30	1.10
Safety Motivation	1. It's worthwhile to maintain or improve personal safety.	6.14	0.84
	2. It's important to maintain safety at all times.	6.25	0.82
	3. It's important to reduce risk in workplace.	6.34	0.79
Safety Compliance	1. Pay full attention to the pre-flight briefing.	6.17	0.78
	2. Follow correct safety procedures for carrying out job.	6.30	0.75
	3. Ensure the highest level of safety when carry out job.	6.24	0.79
Safety Participation	1. I promote the safety program within the organization.	5.36	1.33
	2. I put in extra effort to improve the flight safety.	5.76	1.10
	3. I voluntarily carry out tasks or activities that help to improve flight safety.	5.29	1.27

4.1.3 Dimensionality of the SMS Practice

To condense the size of SMS scale, the principle component analysis with VARIMAX rotation has been employed. The results identify two factors consisting of 17 items. A factor is retained only if it had an eigenvalue greater than 1.0. Items are kept if they have factor loadings greater than 0.5 in a single factor only. Six items thus have been removed from the scale. The two factors explain 71.86% of total variance for the SMS practice evaluation scale (see Table 4.3). According to the VARIMAX-rotated factor pattern, the first factor concerns "policy" (seven items, $\alpha = 0.95$) while the second relates to "practice"

(ten items, α = 0.95). The mean scores by averaging the associated items for each factor are calculated and used in subsequent analyses. Two sub-constructs are named "Policy" and "Practice", respectively.

Table 4.3 Principle Component Analysis of SMS Practice Evaluation Scale

		Factor loadings	Eigen value	Variance explained (%)	Cumulated Variance explained (%)
Factor 1: Policy (PO) **(Mean = 4.99, S.D. = 1.37, α = 0.95)**			15.29	66.48	66.48
PO1:	Company develops the precise standard to monitor and evaluate the SMS practice.	.745			
PO2:	Company continuously improves the SMS practice.	.809			
PO3:	Company's internal reporting channel is highly accessible.	.684			
PO4:	Top management participates in the SMS related activities.	.784			
PO5:	Management handles safety issues following just culture.	.781			
PO6:	Top management declares a determination to execute SMS, even when the company finance is in a down cycle.	.822			
PO7:	Top management declares commitment in formal documents.	.764			
Factor2: Practice (PR) **(Mean = 5.02, S.D. = 1.14, α = 0.95)**			1.24	5.38	71.86
PR1:	Employees are trained to execute the plan periodically.	.649			
PR2:	Company simulates the plan periodically.	.763			
PR3:	Company establishes the plan with clear procedures and individual responsibility.	.744			
PR4:	The contents of the SMS manual are readily understood.	.677			
PR5:	Employees upgrade their self-management abilities through training.	.726			
PR6:	Employees learn comprehensive concepts of SMS through trainings.	.775			
PR7:	Company provides continuous training.	.775			
PR8:	Employees know how to execute SMS through training.	.788			
PR9:	Company provides diverse training programs.	.783			
PR10:	Company holds regular SMS promotion activities.	.764			

4.1.4 Measurement Model

To test the measurement model, confirmatory factor analysis was conducted to analyze the validity and reliability of the six constructs. According to Hair et al. (2006), the convergent validity of CFA results has to be supported by item reliability, construct reliability and average variance extracted. In order to obtain better fit indices for the

measurement model, pilots' perceived self-efficacy is handled as one unified construct. In previous research, there was vigorous evidence supporting that the General Self-efficacy scale is unidimensional (e.g. Schwarzer and Born, 1997). The scores of the ten items of self-efficacy construct thus are averaged to acquire mean scores for the subsequent analyses.

As shown in Table 4.4, all *t* values appear to be significant ($p < 0.01$). The construct reliability estimates (CR) range from 0.86 to 0.95, exceeding the critical value of 0.60 suggested by Fornell and Larcker (1981). The average variances extracted (AVE) of all constructs range between 0.52 and 0.81, also above the value of 0.50 suggested by Fornell and Larcker (1981). These results show that the measurement items all meet the requirements for both reliability and validity. The fit indices of the measurement model are summarized as follows: $\chi^2 = 645.82(p = 0.0)$, df = 271, $\chi^2/df = 2.61$, RFI= 0.94, NFI = 0.95, and NNFI= 0.96. The alternative indices are CFI= 0.97, RMR =0.05, and RMSEA= 0.07.

Table 4.4 Convergent Validity of Model A

Constructs	Indicators	Item reliability			CR	AVE
		Standardized Factor loadings	Standard errors	*t*-Value		
SMS Practice	PO	0.87	0.25	15.84	0.90	0.80
	PR	0.93	0.13	17.56		
Morality Leadership	ML1	0.93	0.13	18.86	0.95	0.81
	ML2	0.94	0.11	19.36		
	ML3	0.84	0.30	15.96		
	ML4	0.90	0.20	17.65		
	ML5	0.88	0.23	17.18		
Self -efficacy	SE1	0.56	0.50	9.80	0.91	0.52
	SE2	0.50	0.50	8.51		
	SE3	0.62	0.61	10.13		
	SE4	0.74	0.45	12.95		
	SE5	0.73	0.47	12.57		
	SE6	0.74	0.46	12.89		
	SE7	0.80	0.34	14.48		
	SE8	0.74	0.45	12.78		
	SE9	0.80	0.37	14.37		
	SE10	0.74	0.45	12.67		
Safety Motivation	MO1	0.83	0.37	13.53	0.91	0.77
	MO2	0.92	0.15	17.53		
	MO3	0.90	0.19	17.23		
Safety Compliance	SC1	0.89	0.21	16.02	0.90	0.75
	SC2	0.85	0.28	16.84		
	SC3	0.85	0.27	16.82		
Safety Participation	SP1	0.78	0.40	12.77	0.86	0.66
	SP2	0.89	0.25	14.85		
	SP3	0.79	0.37	12.92		

Cronbach's α values, the inter-factor correlations and discriminant validity are displayed in Table 4.5. All scales demonstrate good reliability, indicated by presenting the Cronbach's α values above 0.80, thus satisfying the criterion of 0 .70 (Nunnally, 1978). The discriminant validity was assessed to confirm that each construct is absolutely distinct from others (Fornell and Larcker, 1981). The results shown in Table 4.5 indicate that the square root of the average variance extracted for each construct is greater than the levels of the correlations involving the construct, and thus the discriminant validity of the measurement model for flight crew's safety behavior is confirmed.

Table 4.5 Cronbach's α Values, Inter-factor Correlations and Discriminant Validity (Model A)

Constructs	M	SD	1	2	3	4	5	6
1. SMS	4.99	1.07	.89 (.95)					
2. ML	4.65	1.35	.54**	.90 (.95)				
3. SE	5.33	0.77	.43**	.21**	.72 (.86)			
4. MO	6.24	0.75	.33**	.22**	.36**	.88 (.90)		
5. SC	6.24	0.72	.41**	.27**	.50**	.74**	.87 (.91)	
6. SP	5.47	1.08	.51**	.32**	.39**	.40**	.53**	.77 (.84)

Note: * denotes p <0.05, ** denotes p < 0.01.

SMS, Safety Management System practice; ML, Morality Leadership; SE, Self-efficacy; MO, Safety Motivation; SC, Safety Compliance; SP, Safety Participation. Square root of average variance extracted (AVE) is shown on the diagonal of the matrix. Numbers in the parentheses indicate the Cronbach's α values of each construct.

Regarding the potential single-source bias issue, the results of Harman's single-factor test and confirmatory factor analysis provide primary quantitative evidence that common method variance is not a significant concern in this study.

All 41 items were first undergone exploratory factor analysis using principal component analysis with varimax rotation. A factor was retained only if it had an eigenvalue greater than 1.0. The results identified six factors which explain 73.40% of total

variance. Moreover, the results of the confirmatory factor analysis indicated that the single-factor model did not fit the data well, as χ^2 = 2850.75 (p = 0.0), df = 119, χ^2 /df = 23.94, GFI = 0.42, RFI= 0.66, and NFI = 0.70. The alternative indices are CFI= 0.72, RMR =0.20, and RMSEA= 0.31.

In addition, a competing model, which partials out the indicators being double loaded onto both independent and dependent constructs, was developed to control the shared variance based on the source of the rating when assessing the significance of the structural paths. The comparison of the structural coefficients between both models is presented in the Table 4.6.

The results suggested that common method variance had some effect on the significance of a couple of paths (from SMS to safety compliance and from Self-efficacy to safety participation). Although most of the paths remained their results shown in the full model, the possibility of common method variance was not completely excluded. However, the goodness of fit indices suggest a reasonably-fitting model for the competing model (χ^2 = 179.28 (p = 0.0), df = 65, χ^2 /df = 2.76, RMSEA= 0.08), thus it implied that common method variance was unlikely to confound the interpretations of the research results.

Table 4.6 Parameter Estimates for the Paths in Full Structural Model and Competing Model (Model A)

Path Description	Full Structural Model	Competing Model
SMS → Safety Motivation	0.22	0.26
SMS → Safety Compliance	0.14	0.12^{ns}
SMS → Safety Participation	0.37	0.40
Morality Leadership → Safety Motivation	0.21	0.13
Morality Leadership → Safety Compliance	0.04^{ns}	0.03^{ns}
Morality Leadership → Safety Participation	0.06^{ns}	0.02^{ns}
Self -efficacy → Safety Motivation	0.25	0.25
Self -efficacy → Safety Compliance	0.24	0.25
Self -efficacy → Safety Participation	0.13	0.10^{ns}
Safety Motivation → Safety Compliance	0.70	0.54
Safety Motivation → Safety Participation	0.30	0.33

Note: ns indicates non-significance.

4.1.5 Structural Model and Hypotheses Testing

Figure 4.1 shows the estimated model with standardized path coefficients. The fit indices of the structural model are summarized as follows: $\chi^2 = 647.49$(p = 0.0), df = 272, χ^2 /df = 2.38, GFI = 0.87, AGFI = 0.84, RFI= 0.93, NFI = 0.95, and NNFI= 0.96. The alternative indices are CFI= 0.97, RMR =0.05, and RMSEA= 0.07. A comparing of these results with the corresponding critical values suggests a reasonably-fitting model (Hair et al., 2006).

The effect of safety motivation on safety behaviors is significantly positive (β_1=0.70, t= 11.71; β_2=0.30, t= 4.18), indicating that the stronger pilots' safety motivation is, the more likely they will carry out safety behaviors. Hypothesis A1a and A1b are thus confirmed. Regarding the direct effect of three exogenous predictors on pilots' safety motivation, all paths show a significantly direct influence, and thus hypotheses A2, A4 and A6 are all

supported. The statistical data also reveals the direct effect which perceived SMS practice and self-efficacy have on pilots' safety behaviors (e.g. γ_1= 0.37, t = 4.12; γ_9= 0.24, t = 3.43), and hypotheses A3 and A7 are thus supported. The insignificant coefficients found between morality leadership and both safety behaviors (γ_4=0.04, t = 0.80; γ_6=0.06, t = 0.80) identified the rejection of hypotheses A5a and A5b.

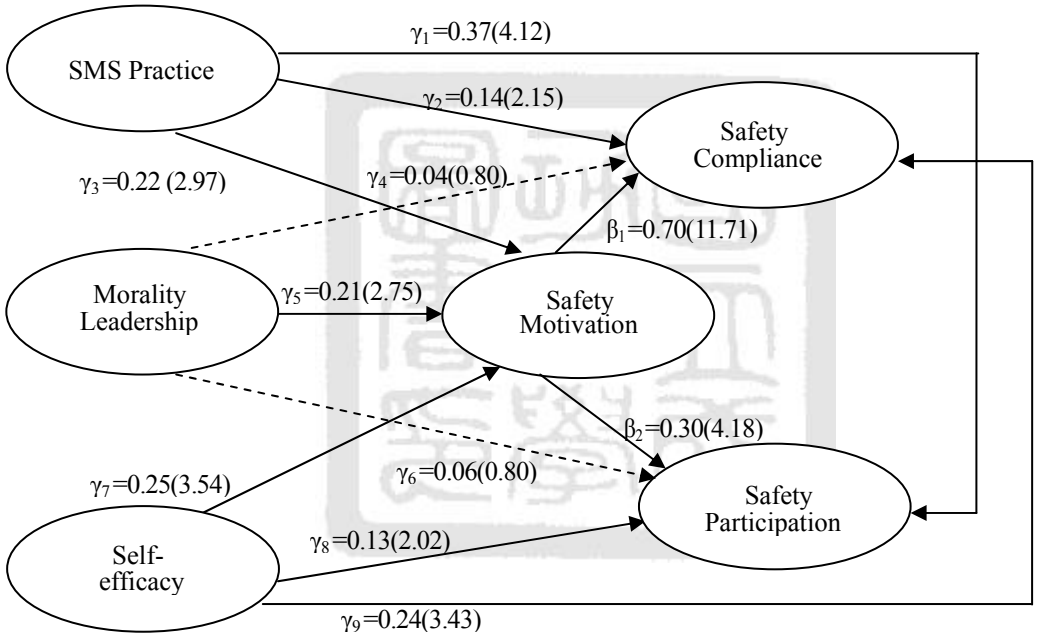


Figure 4.1 The Estimated Model of Flight Crew Safety Behaviors

4.1.6 Mediating Effects of Safety Motivation

Regarding the mediating effects of safety motivation, the following tests have been conducted by applying multiple regression analyses to assess each component of the proposed mediation model. Mediation analyses were tested using the bootstrapping method

with bias-corrected confidence estimates (Mackienon et al., 2004; Preacher and Hayes, 2004). First was to test the mediating effects which safety motivation may have on flight crew's perceptions of airlines Safety Management System practice (SMS) and their safety behaviors. Second was to test the mediating effects which safety motivation may have on fleet manager's morality leadership and flight crew's safety behaviors. Finally the mediating effects which safety motivation may have on flight crew's perceived self-efficacy and their safety behaviors were tested. The criterion for indicating significant mediating effects are listed as followed：1) The independent variables must significantly predict the dependent variable (c-path). 2) The independent variable must significantly predict the mediating variable (a-path). 3) When independent and mediating variables simultaneously predict the dependent variable, the path coefficient between mediating and dependent variables must be significant (b-path), and the path coefficient between independent and dependent variables must be decreased (c'-path). Also, in the present study, the 95% confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples (Preacher and Mayes, 2008). Zero was not between the lower and upper bound to identify a significant mediating effect.

4.1.6.1 Mediating Effect on SMS Practice and Pilots' Safety Behaviors

The mediating effect which safety motivation (MO) may have on SMS and pilots' safety compliance (SC) was first examined. It was found that pilots perceptions of airlines SMS practice is positively associated with their safety compliance (B= 0.29, t = 7.48, p= 0.00). It was also found that pilots perceived airlines SMS practice is positively related to their safety motivation (B= 0.25, t = 5.86, p= 0.00). Lastly, results indicated that the mediator, pilots' safety motivation, was positively associated with their safety compliance (B= 0.66, t = 15.73, p= 0.00). Because both the a-path and b-path were significant, mediation analyses were tested using the bootstrapping method with bias-corrected

confidence estimates. Results of the mediation analysis confirmed the mediating role of safety motivation in the relation between pilots' perceptions of SMS practice and individual safety compliance (B= 0.16; CI= 0.11 to 0.23). In addition, results indicated that direct effects of SMS on SC decrease (B= 0.13, t = 4.38, p= 0.00) when controlling for MO, thus suggesting significant mediating effect.

As for the mediating effect of MO on SMS and flight crew's safety participation (SP), the results indicated that pilots perceived airlines SMS practice is positively associated with their safety participation (B= 0.53, t = 9.43, p= 0.00). Meanwhile, pilots perceived airlines SMS practice is positively related to their safety motivation (B= 0.25, t = 5.86, p= 0.00). It was also found that the mediator, pilots' safety motivation, was positively associated with their safety participation (B= 0.41, t = 4.95, p= 0.00). Because both the a-path and b-path were significant, mediation analyses were conducted. Results of the mediation analysis confirmed the mediating role of safety motivation in the relation between pilots' perceived SMS practice and individual safety participation (B= 0.10; CI= 0.06 to 0.16), also indicated by the decrease of direct effects of SMS on SP decrease (B= 0.43, t = 7.47, p= 0.00) when controlling for MO.

4.1.6.2 Mediating Effect on Fleet Manager's Morality Leadership and Pilots' Safety Behaviors

The mediating effect which safety motivation (MO) may have on fleet manager's morality leadership (ML) and pilots' safety compliance (SC) was first examined. It was found that fleet manager's morality leadership is positively associated with their safety compliance (B= 0.15, t = 4.36, p= 0.00). It was also found that fleet manager's morality leadership is positively related to their safety motivation (B= 0.13, t = 3.60, p= 0.00).

Lastly, results indicated that the mediator, pilots' safety motivation, was positively associated with their safety compliance (B= 0.70, t = 16.99, p= 0.00). Because both the a-path and b-path were significant, mediation analyses were tested Results of the mediation analysis confirmed the mediating role of safety motivation in the relation between fleet manager's morality leadership and individual safety compliance (B= 0.90; CI= 0.05 to 0.14). In addition, results indicated that direct effects of ML on SC become non-significant (B= 0.06, t = 1.02, p = 0.18) when controlling for MO, thus suggesting full mediation.

As for the mediating effect of MO on ML and flight crew's safety participation (SP), it was found that fleet manager's morality leadership is positively associated with their safety participation (B= 0.26, t = 4.68, p= 0.00). It was also found that fleet manager's morality leadership is positively related to their safety motivation (B = 0.23, t = 3.60, p = 0.00). Lastly, results indicated that the mediator, pilots' safety motivation, was positively associated with their safety participation (B = 0.55, t = 6.45, p = 0.00). Because both the a-path and b-path were significant, mediation analyses were tested. Results of the mediation analysis confirmed the mediating role of safety motivation in the relation between fleet manager's morality leadership and individual safety participation (B = 0.07; CI = 0.03 to 0.12). In addition, results indicated that direct effects of ML on SP decrease (B = 0.14, t = 3.94, p = 0.03) when controlling for MO.

4.1.6.3 Mediating Effect on Self-efficacy and Pilots' Safety Behaviors

The mediating effect which safety motivation (MO) may have on pilots' self-efficacy (SE) and their safety compliance (SC) was first examined. It was found that pilots' individual self-efficacy is positively associated with their safety compliance (B = 0.47, t

= 8.94, p = 0.00). It was also found that pilots' individual self-efficacy is positively related to their safety motivation (B = 0.36, t = 5.96, p = 0.00). Lastly, results indicated that the mediator, pilots' safety motivation, was positively associated with their safety compliance (B = 0.63, t = 15.66, p = 0.00). Because both the a-path and b-path were significant, mediation analyses were tested. Results of the mediation analysis confirmed the mediating role of safety motivation in the relation between pilots' individual self-efficacy and individual safety compliance (B = 0.23; CI = 0.15 to 0.31). In addition, results indicated that direct effects of SE on SC decrease (B = 0.25, t = 6.24, p =0.00) when controlling for MO.

As for the mediating effect of MO on SE and flight crew's safety participation (SP), the results indicated that pilots' individual self-efficacy is positively associated with their safety participation (B = 0.55, t = 6.37, p = 0.00). It was also found that pilots' individual self-efficacy is positively related to their safety motivation (B = 0.36, t = 5.96, p = 0.00). Lastly, results indicated that the mediator, pilots' safety motivation, was positively associated with their safety compliance (B = 0.49, t = 5.54, p = 0.00). Mediation analyses were then tested. Results of the mediation analysis confirmed the mediating role of safety motivation in the relation between pilots' individual self-efficacy and individual safety participation (B = 0.17; CI = 0.10 to 0.27). In addition, results indicated that direct effects of SE on SC reduce (B = 0.37, t = 4.30, p = 0.00) when controlling for MO.

Table 4.7 presents the effects (i.e. direct, indirect, and total effects of the estimated model with standardized path coefficients) of the three determinants on pilots' safety compliance and safety participation. While morality leadership has only an indirect effect, the other two antecedents have both direct and indirect ones.

Table 4.7 Direct, Indirect, and Total Effects on Safety Compliance and Safety Participation in Model A

Path	Direct Effect	Indirect Effect	Total effect
SMS practice → Safety compliance	0.14	0.15	0.29
SMS practice → Safety participation	0.37	0.06	0.43
Morality leadership → Safety compliance	—	0.15	0.15
Morality leadership → Safety participation	—	0.06	0.06
Self-efficacy → Safety compliance	0.24	0.18	0.42
Self-efficacy → Safety participation	0.13	0.11	0.24

4.1.7 Discussion

Model A applies multi-aspects (e.g. organizational, group, individual) of antecedents to observe their possible impact on pilots' safety behaviors. The results demonstrate that these behaviors are influenced by pilots' perceptions of airlines SMS practice, fleet manager's morality leadership and self-efficacy simultaneously. The mediating role of safety motivation has also been confirmed with the empirical data.

Pilots' perceived airlines' SMS practice has significant and positive effects on pilots' safety motivation, compliance and participation. The result implies that while airlines devote more efforts to executing an SMS program, pilots are more likely to acknowledge the advantages which an SMS may have with regard to enhancing the entire organization's safety perceptions and operations, and thus work even harder to meet their job requirements and take more initiatives to participate in the related programs to promote safety. It may assume that the determination of airlines executives to improve safety needs to be embodied in the company's operations, as this can then convey to all staff the importance that top managers place on this issue (Hsu et al., 2010). Since it is essential to develop proactive safety measures to identify safety issues in the airline industry, especially regarding to monitoring human-related safety factors (Chang and Yeh, 2004), an

SMS should be adopted due to its significant effects on pilots' safety behaviors.

As for the group-aspect indicator, namely fleet manager's morality leadership, the results do not show that it has a significantly direct effect on pilots' safety behaviors, although the causal relationship is positive. This finding does not reconfirm the strong causality between leadership and employees' safety behaviors, which previous research observed (e.g. Clarke and Ward, 2006; Yang et al., 2009). However, the conceptual model used in this work also proposes that safety motivation mediates the relationships among the selected predictors and pilots' safety behaviors. The statistical data verifies that safety motivation mediates the hypothesized links from morality leadership to pilots' safety compliance and safety participation. To the best of the authors' knowledge, the present study represents the initial attempt to investigate how managers' morality leadership may influence pilots' safety behaviors. The results indicate that fleet manager's morality leadership will enhance pilots' safety motivation, which has a significant impact on pilot's safety behaviors.

A number of reasons may explain these findings. Pilots are widely-recognized as highly professional crew members, and their behavior follows their training. With the morality leadership carried out by the fleet manager, pilots may be motivated to exert greater efforts in their work, although this may not directly translate into actions. In addition, pilots work with other cockpit crew members in their regular duty hours, sharing information and learning from each other rather than following a single manager. The typical relationship between managers and subordinates may not entirely apply to a fleet manager and their pilots. Therefore the influence of leadership on pilots' behaviors may need to be interpreted from different perspectives.

In terms of the effects which self-efficacy has on pilots' safety motivation and

behaviors, all of the path coefficients in this work are found significant, as hypothesized. Pilots with higher self-efficacy are more motivated to perform safety behaviors. The similar results were found in prior research, which showed that self-efficacy positively influences organizational behaviors (e.g. Prinzel, 2002). As indicated by Bandura (1997), a high level of self-efficacy is linked to superior performance, and thus it is essential for airlines to recognize the positive effects which self-efficacy may generate. Although self-efficacy is often viewed as part of an individual's inherent character, it can be fostered by appropriate training (Gist et al., 1989). Offering training programs constructed with the aid of psychology experts is thus one way to increase pilots' self-efficacy.

4.2 CABIN CREW SAFETY BEHAVIOR

How cabin crew's safety behaviors are influenced by the flight attendants' perceptions of airlines SMS practice, department managers' benevolent leadership and individual core self-evaluations is analyzed in this section. The results of demographic characteristics of flight attendant respondents, descriptive statistics, measurement model test, structural model and hypotheses test, and mediating effect examination are addressed in sequence. Totally 296 usable samples out of 450 mailing out questionnaires were collected, representing an acceptable response rate of 66 %.

4.2.1 Demographic Characteristics of Flight Attendant Respondents

The respondents' profile is presented in Table 4.8. The samples are mostly female (91.6%). Their age was mostly between from 26 to 30 (42.9%). Respondents' years of tenure in their current company mainly fell into the range of 1 to 5 years (36.8%). 72.3% of the samples are ranked as flight attendant, 19.3% of the samples had a position as deputy

purser and 8.4% were chief pursers. 54.1% of the respondents had average 70 to 80 flight hours within previous three months. The 69.9% of samples were single and 83.8% of the respondents had no child.

Table 4.8 The Respondents Profile of Cabin Crew (N = 296)

Demographic characteristics	Frequency	Percentage (%)
Gender		
Female	271	91.6
Male	25	8.4
Age		
Below 25	42	14.2
26-30	127	42.9
31-35	70	23.6
36-40	47	15.9
Over 41	10	3.4
Tenures of Year in Current Company		
Less than 1 years	40	13.5
1-5 years	109	36.8
6-10 years	71	24.0
11-15 years	51	17.2
16-20 years	25	8.4
Average Flight Time within Previous Three Months		
Less than 70 hours	48	16.2
70-80 hours	160	54.1
81-100 hours	88	29.7
Position		
Flight Attendant	214	72.3
Deputy Purser	57	19.3
Chief Purser	25	8.4
Marital Status		
Married	89	30.1
Single	207	69.9
Number of Children		
None	248	83.8
1 Child	35	11.8
2 Children	10	3.4
3 Children or More	3	1.0

4.2.2 Descriptive Statistics Results

The detailed information regarding means and standard deviations (S.D.) of the observable items is presented in Table 4.9. In general, flight attendants perceive moderately high level of airlines SMS practice and core self-evaluations, since the construct mean scores are between 4.8 and 5.1. However, department manager's benevolent leadership is

assessed rather low, the construct mean score is only 3.82. In average, flight attendants hold moderate attitude toward conducting upward safety communication and safety participation, while safety compliance behavior is sensed more obligated for cabin crew to execute.

Table 4.9 Descriptive Statistics Results of Model B

Constructs		Items	Mean	S.D.
SMS Practice	PO	1. Precise standard of the SMS practice.	5.07	1.59
		2. Continuously improves the SMS practice.	4.90	1.48
		3. Internal reporting channel is highly accessible.	4.49	1.62
		4. Top management participates.	4.86	1.63
		5. Following the principles of fairness and justice.	4.78	1.60
		6. Clearly stated its determination to execute SMS.	4.46	1.55
		7. Declares commitment in formal documents.	5.22	1.43
	PA	1. Employees periodically take training programs.	5.16	1.44
		2. Company periodically runs drills to practice plans.	5.70	1.40
		3. Company establishes the plan with clear procedures and individual responsibility.	5.62	1.39
		4. The contents of the SMS manual are readily understood.	5.27	1.50
		5. Employees upgrade abilities through training programs.	4.75	1.65
		6. Employees learn concepts through training.	4.75	1.67
		7. Company continuously provides training programs.	5.41	1.41
		8. Employees know how to execute SMS through training.	4.72	1.70
		9. Company provides diverse training programs.	4.36	1.66
		10. Company holds SMS promotion activities regularly.	5.35	1.39
Benevolent Leadership		1. Supervisor expresses concern about daily life beyond work.	4.04	1.67
		2. Supervisor shows a kind concern for the comfort.	4.01	1.85
		3. Supervisor helps when in an emergency.	3.70	1.67
		4. Supervisor takes thoughtful care.	3.99	1.82
		5. Supervisor also takes good care of family members.	3.37	1.68
Core Self-evaluations		1. I am confident I get the success I deserve in life.	5.15	1.05
		2. Sometimes I feel depressed. (R)	4.60	1.42
		3. When I try, I generally succeed.	5.00	1.04
		4. Sometimes when I fail I feel worthless. (R)	5.15	1.40
		5. I complete tasks successfully.	5.32	0.89
		6. Sometimes, I do not feel in control of my work. (R)	4.41	1.16
		7. Overall, I am satisfied with myself.	5.41	1.06
		8. I am filled with doubts about my competence. (R)	5.39	1.24
		9. I determine what will happen in my life.	5.16	1.14
		10. I do not feel in control of my success in my career. (R)	4.48	1.14
		11. I am capable of coping with most of my problems.	5.28	0.93
		12. Sometimes things look pretty bleak and hopeless. (R)	5.30	1.38
Upward Safety Communication		1. I'd like to propose suggestions regarding safety issues.	4.64	1.32
		2. I feel comfortable discussing safety with supervisor.	4.16	1.27
		3. I try to avoid talking about safety with supervisor. (R)	4.34	1.40
		4. Supervisor openly accepts ideas for improving safety.	4.18	1.24
		5. I am reluctant to discuss safety-related problems with supervisor. (R)	4.61	1.45
		6. Supervisor encourages open communication about safety.	4.34	1.19

Table 4.9 Descriptive Statistics Results of Model B (continued)

Constructs	Items	Mean	S.D.
Safety Compliance	1. Make sure all emergency equipment has been well-loaded.	5.76	1.18
	2. Use the correct safety procedures for carrying out my job.	5.67	1.22
	3. Ensure the highest level of safety on board.	5.61	1.24
Safety Participation	1. I promote the safety program within the organization.	4.80	1.45
	2. I put in extra effort to improve the safety on board.	5.09	1.48
	3. Voluntarily carry out tasks or activities to improve safety.	4.57	1.59

4.2.3 Measurement Model

Confirmatory factor analysis was conducted to analyze the validity and reliability of the six constructs. As shown in Table 4.10, all *t* values appear to be significant ($p < 0.01$). The construct reliability estimates (CR) range from 0.90 to 0.97, well above the critical value of 0.70 suggested by Hair et al. (1998). The average variance extracted (AVE), which measures the amount of variance that is captured by the latent variable in relation to the amount of variance due to measurement error, lies between 0.54 and 0.91, also exceeding the value of 0.50 suggested by Fornell and Larcker (1981). These results indicate that the measurement items have high reliability and validity. The fit indices of the measurement model are summarized as follows: $\chi^2 = 1024.80(p = 0.0)$, $df = 401$, $\chi^2/df = 2.55$, RFI= 0.97, NFI = 0.97, and NNFI= 0.98. The alternative indices are CFI= 0.98, RMR =0.05, and RMSEA= 0.08.

Table 4.10 Convergent Validity of Model B

Constructs	Indicators	Item reliability			CR	AVE
		Standardized Factor loadings	Standard errors	*t*-Value		
SMS Practice	PO	0.95	0.09	21.79**	0.95	0.91
	PA	0.95	0.08	22.12**		
Benevolent Leadership	BL1	0.92	0.15	20.82**	0.97	0.86
	BL2	0.94	0.11	21.68**		
	BL3	0.94	0.12	21.60**		
	BL4	0.94	0.11	21.53**		
	BL5	0.93	0.14	21.05**		
Core Self-evaluations	CSE1	0.76	0.42	15.17**	0.91	0.54
	CSE2	0.65	0.56	12.32**		
	CSE3	0.72	0.49	13.93**		
	CSE4	0.74	0.44	14.68**		
	CSE5	0.73	0.47	14.27**		
	CSE6	0.65	0.57	12.07**		
	CSE7	0.90	0.19	19.61**		
	CSE8	0.76	0.40	15.43**		
	CSE9	0.67	0.56	12.99**		
	CSE10	0.66	0.56	12.30**		
	CSE11	0.71	0.50	13.75**		
	CSE12	0.78	0.42	15.16**		
Upward Safety Communication	USC1	0.82	0.33	16.86**	0.90	0.81
	USC2	0.84	0.30	17.50**		
	USC3	0.68	0.52	13.14**		
	USC4	0.81	0.34	16.63**		
	USC5	0.78	0.39	15.57**		
	USC6	0.73	0.46	14.21**		
Safety Compliance	SC1	0.90	0.19	19.72**	0.94	0.84
	SC2	0.95	0.09	21.82**		
	SC3	0.91	0.18	20.06**		
Safety Participation	SP1	0.91	0.16	20.40**	0.94	0.86
	SP2	0.94	0.12	21.45**		
	SP3	0.94	0.14	21.10**		

Cronbach's α values, the inter-factor correlations and discriminant validity are displayed in Table 4.11. All scales demonstrate good reliability, indicated by presenting the Cronbach's α values above 0.80, thus satisfying the criterion of 0 .70 (Nunnally, 1978). The discriminant validity was assessed to confirm that each construct is absolutely distinct from others (Fornell and Larcker, 1981). The results shown in Table 4.10 indicate that the

square root of the average variance extracted for each construct is greater than the levels of the correlations involving the construct, and thus the discriminant validity of the measurement model for cabin crew's safety behavior is confirmed.

Table 4.11 Cronbach's α Values, Inter-factor Correlations and Discriminant Validity (Model B)

Constructs	M	SD	1	2	3	4	5	6
1. SMS	4.99	1.38	.95(.95)					
2. BL	3.82	1.66	.75**	.93(.93)				
3. CSE	5.06	0.85	.49**	.56**	.73 (.89)			
4. USC	4.38	1.09	.73**	.78**	.56**	.90 (.88)		
5. SC	5.68	1.15	.63**	.61**	.46**	.60**	.92(.94)	
6. SP	4.82	1.44	.74**	.78**	.52**	.77**	.78**	.92(.93)

Note: * denotes p <0.05, ** denotes p < 0.01.

SMS, Safety Management System practice; BL, Benevolent Leadership; CSE, Core Self-evaluations; USC, Upward Safety Communication; SC, Safety Compliance; SP, Safety Participation. Square root of average variance extracted (AVE) is shown on the diagonal of the matrix. Numbers in the parentheses indicate the Cronbach's α values of each construct.

Regarding the potential single-source bias issue, Harman's single-factor test and confirmatory factor analysis have applied to provide primary quantitative evidence, in which the results indicated that common method variance is not a significant concern in this study. All 46 items were undergone exploratory factor analysis using principal component analysis with varimax rotation. A factor was retained only if it had an eigenvalue greater than 1.0. The results identified five factors which explain 76.72% of total variance. Moreover, the results of the confirmatory factor analysis indicated that the single-factor model did not fit the data well, as $\chi^2 = 15535.63$ (p = 0.0), df = 989, $\chi^2/df = 15.71$, GFI = 0.30, RFI= 0.82, and NFI = 0.81. The alternative indices are CFI= 0.88, RMR =0.12, and RMSEA= 0.22.

In addition, a competing model, which partials out the indicators being double loaded onto both independent and dependent constructs, was developed to control the shared variance based on the source of the rating when assessing the significance of the structural paths. The comparison of the structural coefficients between both models is presented in the Table 4.12. The results suggest that common method variance had some effect on the significance from benevolent leadership to safety participation, and from core self-evaluations to upward safety communication. Although most of the paths remained their results indicated in the full model, the possibility of common method variance was not completely excluded. However, the goodness of fit indices suggest a reasonably-fitting model for the competing model (χ^2 = 660.29 (p = 0.0), df = 321, χ^2 /df = 2.06, RMSEA= 0.09), it thus implied that common method variance was unlikely to confound the interpretations of the research results.

Table 4.12 Parameter Estimates for the Paths in Full Structural Model and Competing Model (Model B)

Path Description	Full Structural Model	Competing Model
SMS→Upward Safety Communication	0.32	0.31
SMS→Safety Compliance	0.31	0.20
SMS→Safety Participation	0.20	0.15
Benevolent Leadership→Upward Safety Communication	0.50	0.48
Benevolent Leadership→Safety Compliance	0.09^{ns}	-0.08^{ns}
Benevolent Leadership→ Safety Participation	0.30	0.12^{ns}
Core Self -evaluations→Upward Safety Communication	0.12	0.10^{ns}
Core Self-evaluations→Safety Compliance	0.15	0.12
Core Self -evaluations→Safety Participation	0.07^{ns}	0.07^{ns}
Upward Safety Communication→ Safety Compliance	0.26	0.45
Upward Safety Communication→ Safety Participation	0.39	0.56

Note: ns indicates non-significance.

4.2.4 Structural Model and Hypotheses Testing

Figure 4.2 shows the estimated model with standardized path coefficients. The fit indices of the structural model are summarized as follows: $\chi^2 = 250.08$(p = 0.0), df = 105, χ^2/df = 2.38, RFI= 0.94, NFI = 0.96, and NNFI= 0.97. The alternative indices are CFI= 0.97, RMR =0.04, and RMSEA= 0.07. A comparing of these results with the corresponding critical values suggests that the conceptual model fits the empirical data reasonably well (Fornell and Larcker, 1981).

Regarding the hypotheses tests, five out of the seven hypotheses are supported. The effects of upward safety communication on both types of safety behaviors are significantly positive (β_1=0.26, t= 2.43; β_2=0.39, t= 4.98), indicating that the more positive attitude flight attendants have with regard to conducting upward safety communication, the more likely they will perform compliance and proactive safety behaviors. Hypothesis B1 is thus confirmed. Regarding the direct effect of the three exogenous predictors on cabin crews' upward safety communication, all paths show a significantly direct influence, and thus hypotheses B2, B4 and B6 are all supported. The statistical data also reveals the direct effect which perceived SMS practice has on cabin crew's safety compliance and safety participation (γ_2= 0.31, t = 3.42; γ_1= 0.20, t = 3.09), and hypothesis B3 thus is supported. While department managers' benevolent leadership has a direct effect on cabin crew's safety participation behavior (γ_6= 0.15, t = 2.60), it does not have the same effect on their safety compliance behavior (γ_2= 0.09, t = 0.85). Meanwhile, flight attendants' CSE has a significant positive effect on their safety compliance behavior (γ_9= 0.15, t = 2.60) and insignificant effect on their safety participation behavior (γ_2= 0.07, t = 1.54). Therefore, hypotheses B5b and B7a are found supported, yet hypotheses B5a and B7b are both rejected.

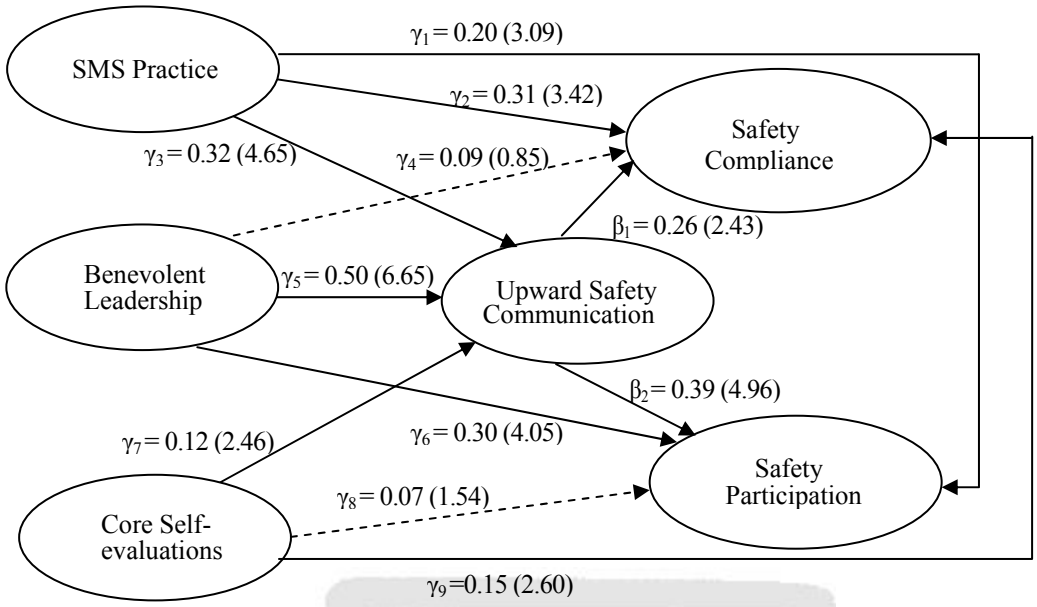


Fig.4.2. The Estimated Model of Cabin Crew Safety Behaviors

4.2.5 Mediating Effects of Upward Safety Communication

Regarding the mediating effects of upward safety communication, the following tests have been conducted by applying multiple regression analyses to assess each component of the proposed mediation model. Consistent to the technique applied in the flight crew's safety behavior study, mediation analyses were tested using the bootstrapping method with bias-corrected confidence estimates (Mackienon et al., 2004; Preacher and Hayes, 2004).

First was to test the mediating effects which upward safety communication may have on cabin crew's perceptions of airlines Safety Management System practice (SMS) and their safety behaviors. Second was to test the mediating effects which upward safety communication may have on department manager's benevolent leadership and cabin crew's safety behaviors. Finally the mediating effects which upward safety communication may have on cabin crew's perceived

core self-evaluations and their safety behaviors were tested. The criterion for indicating significant mediating effects are listed as followed：1) The independent variables must significantly predict the dependent variable (c-path). 2) The independent variable must significantly predict the mediating variable (a-path). 3) When independent and mediating variables simultaneously predict the dependent variable, the path coefficient between mediating and dependent variables must be significant (b-path), and the path coefficient between independent and dependent variables must be decreased (c'-path). Also, in the present study, the 95% confidence interval of the indirect effects was obtained with 5,000 bootstrap resamples (Preacher and Mayes, 2008). Zero was not between the lower and upper bound to identify a significant mediating effect.

4.2.5.1 Mediating Effect on SMS Practice and Flight attendants' Safety Behaviors

The mediating effect which upward safety communication (USC) may have on SMS and flight attendants' safety compliance (SC) is first examined. It was found that flight attendants' perceived airlines SMS practice is positively associated with their safety compliance (B = 0.52, t = 13.69, p = 0.00). It was also found that flight attendants' perceived airlines SMS practice is positively related to their upward safety communication (B = 0.58, t = 18.36, p = 0.00). Lastly, results indicated that the mediator, flight attendants' upward safety communication, was positively associated with their safety compliance (B = 0.33, t = 4.86, p = 0.00). Because both the a-path and b-path were significant, mediation analyses were tested. Results of the mediation analysis confirmed the mediating role of upward safety communication in the relation between flight attendants' perceived airlines SMS practice and individual safety compliance (B = 0.19; CI = 0.09 to 0.29). In addition, results indicated that direct effects of SMS on SC drop (B = 0.33, t= 6.15, p = 0.00) when

controlling for USC, thus suggesting significant mediating effect.

As for the mediating effect of USC on SMS and cabin crew's safety participation (SP), the results indicated flight attendants' perceived airlines SMS practice is positively associated with their safety participation (B = 0.78, t = 19.33, p = 0.00). It was also found that flight attendants' perceived airlines SMS practice is positively related to their upward safety communication (B = 0.58, t = 18.36, p = 0.00). Lastly, results indicated that the mediator, flight attendants' upward safety communication, was positively associated with their safety compliance (B = 0.65, t = 9.92, p = 0.00). Because both the a-path and b-path were significant, mediation analysis tests were conducted. Results of the mediation analysis confirmed the mediating role of upward safety communication in the relation between flight attendants' perceived airlines SMS practice and individual safety participation (B = 0.37; CI = 0.28 to 0.47). In addition, results showed that direct effects of SMS on SP decrease significantly (B = 0.41, t = 7.97, p = 0.00) when controlling for USC also supported the mediation role of upward safety communication.

4.2.5.2 Mediating Effect on Department Manager's Benevolent Leadership and Flight Attendants' Safety Behaviors

The mediating effect which upward safety communication (USC) may have on department manager's benevolent leadership (BL) and flight attendants' safety compliance (SC) is first examined. It was found that department managers' benevolent leadership is positively associated with their safety compliance (B = 0.42, t = 13.20, p = 0.00). Meanwhile, department managers' benevolent leadership is positively related to their upward safety communication (B = 0.51, t = 21.44, p = 0.00). Lastly, results indicated that the mediator, flight attendants' upward safety communication, was positively associated with their safety compliance (B = 0.34, t = 4.48, p = 0.00). Because both the a-path and

b-path were significant, mediation analyses were tested. The results identified the mediating role of upward safety communication in the relation between department managers' benevolent leadership and individual safety compliance (B = 0.18; CI = 0.07 to 0.27). In addition, the result of direct effects of BL on SC decreasing (B = 0.25, t = 5.00, p = 0.00) when controlling for USC also suggesting the mediating effect of upward safety communication.

As for the results of mediating effect of USC on BL and cabin crew's safety participation (SP), it was found that department managers' benevolent leadership is positively associated with their safety participation (B = 0.69, t = 22.32, p = 0.00). In addition, department managers' benevolent leadership was found to be positively related to their upward safety communication (B = 0.51, t = 21.44, p = 0.00). Lastly, results indicated that the mediator, flight attendants' upward safety communication, was positively associated with their safety participation (B = 0.53, t = 7.61, p = 0.00). Because both the a-path and b-path were significant, mediation analyses were tested Results of the mediation analysis confirmed the mediating role of upward safety communication in the relation between department managers' benevolent leadership and individual safety participation (B = 0.27; CI = 0.16 to 0.39). Results of the decrease of direct effects found from BL to SC (B = 0.42, t = 9.29, p = 0.00) when controlling for USC has also supported the argument.

4.2.5.3 Mediating Effect on Core Self-evaluations and Flight Attendants' Safety Behaviors

The mediating effect which upward safety communication (USC) may have on flight attendants' core self-evaluations (CSE) and their safety compliance (SC) is first examined. It was found that flight attendants' individual CSE is positively associated with their safety compliance (B = 0.42, t = 13.20, p = 0.00). The result also found that flight attendants' individual CSE is positively related to their upward safety communication (B = 0.51, t =

21.44, $p = 0.00$). Lastly, results indicated that the mediator, flight attendants' upward safety communication, was positively associated with their safety compliance (B = 0.34, $t = 4.48$, $p = 0.00$). Because both the a-path and b-path were significant, mediation analyses were tested. The mediation analysis test confirmed the mediating role of upward safety communication in the relation between flight attendants' individual CSE and individual safety compliance (B = 0.18; CI = 0.07 to 0.27). In addition, results indicated that direct effects of CSE on SC lessen (B = 0.25, $t = 5.01$, $p = 0.00$) when controlling for USC, thus supporting the mediating role of upward safety communication.

As for the mediating effect of USC on CSE and cabin crew's safety participation (SP), it was found that flight attendants' individual CSE is positively associated with their safety participation (B = 0.62, $t = 8.93$, $p = 0.00$). The results also indicated that flight attendants' individual CSE is positively related to their upward safety participation (B = 0.72, $t = 11.70$, $p = 0.00$). Lastly, the results showed that the mediator, flight attendants' upward safety communication, was positively associated with their safety participation (B = 0.53, $t = 9.01$, $p = 0.00$). Because both the a-path and b-path were significant, mediation analyses were tested. The results confirmed the mediating role of upward safety communication in the relation between flight attendants' individual CSE and individual safety participation (B = 0.38; CI = 0.26 to 0.52). Besides, the direct effects of CSE on SP drop (B = 0.24, $t = 3.24$, $p = 0.00$) when controlling for USC, thus supporting the mediating role of upward safety communication.

Table 4.13 presents the effects (i.e. direct, indirect, and total effects of the estimated model with standardized path coefficients) of the three determinants on flight attendants' safety compliance and safety participation. Only cabin crew's perceptions of airlines SMS practice show both direct and indirect effects on the safety behaviors. Department

manager's benevolent leadership has no direct effect on cabin crew's safety compliance behavior. Meanwhile, cabin crew's core self-evaluations fail to demonstrate the direct effect on their safety participation behavior.

Table 4.13 Direct, Indirect, and Total Effects on Safety Compliance and Safety Participation in Model B

Path	Direct Effect	Indirect Effect	Total effect
SMS practice → Safety compliance	0.31	0.08	0.39
SMS practice → Safety participation	0.20	0.12	0.32
Benevolent leadership → Safety compliance	—	0.13	0.13
Benevolent leadership → Safety participation	0.30	0.20	0.50
Core self-valuations → Safety compliance	0.15	0.03	0.18
Core self-valuations → Safety participation	—	0.05	0.05

4.2.6 Discussion

In the model B, the effects which cabin crew's perceptions of airlines SMS practice, department managers' benevolent leadership and individual CSE have on types of flight attendants' safety behaviors are examined. The results show that these behaviors are simultaneously and positively associated with all three factors. Based on the empirical data, the mediating effect of upward safety communication has also been confirmed. The first statement to make is that when a cabin crewmember is willing to conduct upward safety communication, they are more likely to perform safety behaviors well.

In general, flight attendant respondents recognize that airlines endeavor to practice SMS, as the mean scores of two SMS sub-constructs show 4.83 and 5.11, respectively. Note that airlines' with an accredited SMS practice may be viewed as having a positive organizational safety culture (Lewis, 2008). From a practical perspective, the practice of an

SMS demonstrates the determination of an airline's executives to improve safety, and this can then convey to all employees the importance that their company places on this issue (Hsu et al., 2010), with safety then regarded as a collective responsibility. With the use of an SMS which aims to integrate the entire organization as one team, following principles that are laid down at the top, it is more likely then cabin crew will be motivated to conduct upward safety communication and safety behaviors. This linkage between an airline's SMS practice and flight attendants' safety behaviors supports the findings of Remawi et al. (2011). Consistent with the evidence presented by model A, the empirical results of model B also reveal that cabin crew's perceptions of SMS practice has shown greater influences with regard to their safety behaviors (combining both of safety compliance and safety participation) than the other two selected factors, since it shows the greatest total effect. Airlines may rely on the practice of an SMS not only to support a positive safety culture (FAA, 2006), but also to increase cabin crews' willingness to perform safety behaviors. Therefore, there is no doubt that airlines should dedicate more efforts to perform and promote SMS to enhance cabin crew's safety behaviors.

Similar to the research of pilots' safety behaviors, the study of cabin crew's safety behaviors takes the primary step to investigate whether benevolent leadership leads to subordinates' safety behaviors. The results support the positive relations between department managers' benevolent leadership, cabin crew's upward safety communication and safety participation behavior, while the linkage between benevolent leadership and flight attendants' safety compliance behavior is found insignificant. These findings do not entirely reconfirm what the previous research has proposed (e.g. Inness et al., 2010). However, the insignificant linkage between department managers' benevolent leadership and cabin crew's safety compliance behavior is unexpected but comprehensible. It is mandatory for all cabin crew trainees to pass through safety and emergency procedure

training before being qualified to work as flight attendants (Rhoden et al., 2008). Flight attendants tend to formulate rules of thumb for teamwork and it is thus expected that they will follow this training and comply with the various situations that may arise on-board within limited time. Compared to manager's leadership, personal safety awareness and cooperation between cabin crewmembers seem to have more direct influences on how flight attendants obtain their safety compliance behavior.

Nevertheless, the considerable effect which managers' benevolent leadership has on cabin crew's proactive safety behavior deserves further attention. When flight attendants take the initiative to participate in safety related activities, or help develop a safety-supportive environment, they not only reveal their significant recognition of the importance of safety, but also demonstrate the willingness to perform safety participation behavior. Since reciprocal relationships are highly valued in a Chinese cultural context, social exchange theory has been able to apply in the current model to employ as the theoretical framework linking leadership styles to employee outcomes (Chen et al., 2009). The empirical results proposed by model B provide valuable evidence in support of the argument that cabin crewmembers may transform the respect, gratitude and commitment they feel toward a benevolent leader into making greater efforts to promote safety (Cheng et al., 2004). To motivate flight attendants to communicate upward regarding safety issues and then ensure good safety performance, it is important to encourage department leaders to express personal concerns and cares with regard to their staff. If flight attendants view themselves as working in a warm family-like environment, they are more inclined to participate in safety promotion during off hours. Accordingly, it is noteworthy that the low mean score of benevolent leadership construct in the current study (M=3.82) suggests that flight attendants perceive insufficient fatherly benevolence from the department managers. It is thus strongly recommended that airlines should be aware of the positive effects of

benevolent leadership, and encourage managers employing it as a management technique when supervising flight attendants.

In terms of the possible effects of cabin crew's CSE, the estimated path coefficients reveal significant impacts on upward safety communication and safety compliance behavior, but an insignificant effect on safety participation. Although the relation between core self-evaluations and job performance (e.g. organizational citizenship behaviors) has been supported in previous studies (Judge et al., 1998; Piccolo et al., 2005), to date there has been a lack of empirical data to confirm the causality between individual CSE and safety behavior. The results of model B thus provide the preliminary evidence which shows that individuals tend to perform their safety compliance behavior better when they have higher levels of self-esteem, generalized self-efficacy, locus of control and emotional stability. Since these characteristics are fundamental with regard to how one appraise oneself, others and external environment (Judge et al., 1997), people with higher CSE perceptions are likely to have more positive attitudes toward their personal obligations, and work harder to ensure the completion of their designated tasks. In the case of cabin crew's safety responsibilities, this indicates that flight attendants will pay more attention to their designated safety responsibilities, including reporting irregular situations and conducting a variety of mandatory safety checks. As for cabin crew's safety participation behavior, the results of model B do not support the significant effect of CSE that is hypothesized. From a comprehensive point of view, cabin crew's safety participation behavior identified in the model B is more closely related to the group and organizational levels of the expected tasks than the personal duty. Despite the fact that flight attendants' perceived CSE does not directly lead to safety participation behavior, they will perform it when they have positive attitude toward conducting upward safety communication, which involves interacting with others rather than merely being self-administrated. Airlines thus may consider applying

items from CSE surveys in written tests or face-to-face interviews when recruiting flight attendants to help identify the more appropriate candidates.

4.3 COMPARISON BETWEEN THE TWO MODELS

The current chapter focuses on empirical results analyses and discussion for the two respective studies. The data collected from aircrew respondents' questionnaires were analyzed by multiple analysis methods, including descriptive statistics, reliability analysis, exploratory factor analysis, confirmatory factor analysis, structural equation modeling technique and mediating effects test. In both conceptual models, the results indicate that aircrew's safety behaviors are influenced by organizational, group and individual aspects antecedents simultaneously.

In Section 4.1, the research results regarding the conceptual model of flight crew's safety behavior, denoted as model A, have been presented in detail. The Cronbach's coefficients of all scales demonstrate good reliability for showing the values above 0.80. To condense the evaluation scale of airlines SMS practice, two sub-dimensions with 17 items have been identified by exploratory factor analysis. By using LISREL 8.52 computer program, maximum likelihood parameter estimates are used to examine the convergent validity of the measurement model. All data of CR and AVE exceed the critical values suggested by Fornell and Larcker (1981). Comparing the results data with the corresponding critical values, it suggests that the hypothesized model fits the empirical data well. The structural coefficients indicate a good fit for the proposed model.

With safety motivation serving as the mediator between the selected antecedents and pilots safety behaviors, multiple regression analyses were conducted to assess each component of the proposed mediation model, by using the bootstrapping method with

bias-corrected confidence estimates (Preacher and Mayes, 2004). The research results indicate that pilots' safety compliance and participation behaviors are simultaneously influenced by airlines SMS practice, fleet manager's morality leadership and self-efficacy, either directly or indirectly, through the mediating effects generated by safety motivation.

Section 4.2 attempts to analyze the empirical data collected from the flight attendant respondents' questionnaires. The descriptive statistics, reliability analysis, measurement and structural models, and hypotheses tests were performed in sequence. The estimated model fits well with the empirical data. Five out of seven hypotheses proposed in cabin crew safety behavior model are found supported. Flight attendants' perceived airlines SMS practice significantly and positively lead to cabin crew's upward safety communication, safety compliance and participation behaviors. Department manager's benevolent leadership may enhance flight attendants' safety participation, while it shows the indirect effect on their safety compliance, through the mediating role played by upward safety communication. On the other side, cabin crew's core self-evaluations significantly and positively affect their safety compliance, while upward safety communication completely mediates the causality between CSE and flight attendants' safety participation.

Although the empirical findings in each study have both confirmed that aircrew's safety behaviors may be simultaneously enhanced by the three respectively selected antecedents, some similarities and differences of the research results are summarized for the comparison.

First, organizational aspect's factor (i.e. aircrew's perceived SMS practice) demonstrates significant and positive effects on aircrew's safety compliance and safety participation, directly and indirectly. It indicates that aircrew members are motivated to conduct safety behaviors when they observe the entire organization serving as one team and following the principle of Safety Management System to implement top-down schemes. However, pilots' perceived airlines SMS

practice shows greater impact on their safety participation than on safety compliance, while flight attendants' safety compliance is found to be more positively related to their perceptions of airlines SMS practice than does safety participation. Since flight operation is subject to the strict procedures and under nearly real-time monitor by the advanced flight analysis equipment, pilots are expected to take the initiative to conduct safety compliance behavior (e.g. I use the correct safety procedures for carrying out my job.). Thus it is readily understandable that airlines' SMS practice does not show great impact on pilots' safety compliance. Accordingly, airlines should effectively apply these observations regarding the considerable effects of an SMS program on pilots' safety participation (e.g. I voluntarily carry out tasks or activities that help to improve flight safety.).

On the other hand, in-flight service and safety duties performed by cabin crew on board are constantly overlapped under time constrained. The dilemma between achieving airlines specified service performance standards and the prompt and complete execution of safety duties may possibly lead to the negligence of the details with regard to safety compliance (e.g. During ground check, I will make sure all emergency equipment has been well-loaded.). The empirical findings of the current research thus may suggest feasible strategies to enhance cabin crew's safety behaviors.

Regarding the effects caused by morality leadership and benevolent leadership respectively on flight and cabin crews' safety behaviors, the intriguing discovery of the diversities requires further examination. Pilots are well-known for the professionalism, which surpasses other job related issues. To the best of the author's knowledge, limited research aims to explore the possible relationship between leadership and their organizational behaviors. The current study has provided the empirical data to reveal some possible causes. The positive yet insignificant effects, which fleet managers' morality

leadership have on pilots' safety behavior, imply that the solid linkage between leadership and subordinates' behavior validated by the prior literature remains uncertain among flight crew members. To the contrary, cabin crew position has been widely recognized as a typical representative of teamwork, flight attendants' interpersonal skills are often weighed heavier than work competency. Over the last twenty years, a significant amount of research has been conducted on flight attendants' job outcomes related to organizational behavior and the potential factors (Damos et al., 2013). The large impact (total effect = 0.5) found in the current research, which department managers' benevolent leadership has on cabin crew's safety participation, demonstrates that the parental care and backup expressed by benevolent leaders may enhance the appreciation of striving for "common good" among cabin crew and motivate their exercise of teamwork to achieve the shared goals.

It is not surprising that pilots' self-efficacy and flight attendants' core self-evaluations positively affect their safety behaviors, respectively. However, self-efficacy shows much greater impact on pilots than CSE does on flight attendants. The observed phenomenon is consistent to the aforementioned findings regarding the relationship between leadership and aircrew's safety behaviors. Pilot position emphasizes prominently on personal work related competence and attitude. Individual attributions directly reflect people's self-perceptions and thus contribute significantly to what they expect themselves to accomplish. As for cabin crew, the intrinsic job character of teamwork appreciates team values above the individual values. Although the four dimensions of CSE, namely self-esteem, locus of control, emotional stability, and generalized self-efficacy, are considered critical to the cabin duty requirements, CSE shows insignificant effect on cabin crew's safety participation and only moderately positive effect on the safety compliance. It seems that how personal attributions influence flight attendants' safety citizenship behaviors requires further examination.

With the detailed illustration of the empirical results analyses and discussion in this chapter, the final chapter will present the conclusions and implications of this study. A number of research contributions, implications for practitioners, limitations and directions for future research will be stated.

CHAPTER 5 CONCLUSIONS AND IMPLICATIONS

Followed by the thorough data analyses and discussion in the previous chapter, there are five sections in the final chapter to conclude the major research results and implications. The first section summarizes the major findings drawn from the present study. The second section states the research contributions to both theoretical and empirical fields. Section 5.3 illustrates the various managerial implications for the airlines human resource management. Section 5.4 addresses limitations in this thesis. Finally, the last section proposes directions for future research on the related subjects.

5.1 CONCLUSIONS OF THE STUDY

Research centered on safety and human performance in the aviation industry is complex and involves multi-faceted areas. It contains diverse issues, such as organizational factors as well as individual and interpersonal relationship (Luxhoj, 2001). Since aircrew's safety behavior is critical to airlines safety performance and may directly affect air travelers' safety concern, identifying potential factors which may motivate aircrew's safety behavior is believed to effectively enhance airlines safety management theoretically and in practice. As organizational behavior research tends to categorize employees' behavior predictors into three aspects, namely organization, group and individual (e.g. Robbins, 2001), this thesis aims to develop two conceptual models for simultaneously exploring how respectively selected antecedents representing the three aspects may directly or indirectly enhance flight crew and cabin crew safety behaviors, through the mediating effects of pilots' safety motivation and flight attendant's upward safety communication. According to the research purposes presented in chapter one, the following conclusions are addressed.

Purpose 1：Explore the Effects of Airlines Safety Management System Practice, Fleet Managers' Morality Leadership and Pilots' Self-efficacy Have on Flight Crew's Safety Behaviors.

The results of conceptual model A show that flight crew's perceived airlines SMS practice and self-efficacy significantly and positively predict pilots' safety motivation, safety compliance and participation behaviors. Airlines SMS practice shows the greatest total effect on pilots' safety participation, with the path coefficient of 0.43, while pilots' self-efficacy shows the greatest total effect on their safety compliance with the path coefficient of 0.42. Fleet manager's morality leadership shows the indirect effect on pilots' safety behaviors through the mediator of safety motivation. According to the results of testing the mediating role of safety motivation, the three selected antecedents either directly or indirectly lead to pilots' safety compliance and safety participation. The positive impact of airlines Safety Management System practice, fleet managers' morality leadership and pilots' self-efficacy have on flight crew's safety behaviors have thus been confirmed.

Purpose 2：Explore the Effects of Airlines Safety Management System Practice, Department Managers' Benevolent Leadership and Flight Attendants Core Self-evaluations Have on Cabin Crew's Safety Behaviors.

The conceptual model B aims to examine whether the three selected indicators may enhance cabin crew's upward safety communication and the two types of safety behaviors. The empirical results indicate that cabin crew's perception of their airline's SMS practice has significant effects on their upward safety communication, safety compliance and safety participation. In addition, flight attendants are more likely to conduct upward safety communication and proactive safety behavior with the supervision of benevolent

leadership. Furthermore, the higher flight attendants evaluate their own CSE, the more likely it is that they will comply with safety regulations and follow standard operation procedures.

According to the results of testing the mediating role of upward safety communication, the three selected antecedents either directly or indirectly lead to flight attendants' safety compliance and safety participation. The positive impact of airlines Safety Management System practice, department managers' benevolent leadership and flight attendants' core self-evaluations show on cabin crew's safety behaviors have thus been proved.

Purpose 3：Propose and Empirically Test the Two Conceptual Models Which Simultaneously Link Multi-factors, Mediators and Aircrew's Safety Behaviors.

Undoubtedly aircrew's safety behavior plays an essential role in air transportation safety record. Researching for the possible behavioral linkage between predictors and actual behavior will help identify the crucial factors and feasible strategies to enhance aircrew's safety behavior. To obtain a comprehensive view on the causalities linking to aircrew's safety behavior, it is necessary to take into account the relationships among potential antecedents representing multi-aspects (e.g. organization, group. individual) and related mediators. This study thus aims to propose the two integrated models which respectively present the behavioral links of flight and cabin crews' safety behaviors, with three selective predictors and one mediator for each model.

The research results support most of the hypotheses addressed in the both models and the empirical data fit the conceptual models well. It may thus conclude that the two conceptual models proposed in this thesis are tenable and aircrew's safety behaviors are simultaneously affected by the selected organization, group and individual factors.

Purpose 4：Propose Recommendations for Enhancing Aircrew's Safety Behaviors Based on the Research Findings.

With the two conceptual models developed in the current thesis, adequate research findings are provided as the references to propose practical recommendations for airlines to enhance aircrew's safety behaviors. The selected antecedents in both models have been proved with the directly and indirectly positive effects on aircrew's safety behaviors. Airlines SMS practice, fleet manager's morality leadership, department manager's benevolent leadership, pilots' self-efficacy and flight attendants' core self-evaluations should be all taken into account in order to develop comprehensive strategies for upgrading aircrew's safety performance. Self-efficacy and core self-evaluations may be applied as selection criteria for recruiting appropriate pilot and flight attendant candidates. Moral and benevolent leaderships should be highly recommended and appreciated with regard to aircrew's human resource management. Above all, devoting to practicing SMS is not only for fulfilling the requirements set up by the ICAO, but substantiating organizational safety culture in a positive manner. Aircrew members may perceive the level of effort by observing airlines SMS practice and turn it into the willingness of performing safety behaviors.

Purpose 5：Extend the Understanding of the Related Topics by Contributing the Empirical Results to the Current Literature.

Although it is commonly recognized that employees' organizational behaviors may be viewed as the integration of organization, group and individual characteristics (Champoux, 2010), to date there has been limited research simultaneously linking tri-aspects factors with employees' specific organizational behavior to reveal the linkage with empirical data.

The findings of the current thesis has provided the preliminary substantiation to support that aircrew's safety behaviors (e.g. safety compliance and safety participation) are influenced by multi-factors indicating organizational aspect (e.g. airlines SMS practice), group aspect (e.g. fleet manager's morality leadership, department manager's benevolent leadership) and individual aspect (e.g. flight crew's self-efficacy, cabin crew's core self-evaluations).

Meanwhile, the empirical results identify pilots' safety motivation as an important mediator between the three antecedents and their safety behaviors, while flight attendants' upward safety communication plays an essential mediating role in the proposed model B. To appreciate the complex psychological process of what leads to aircrew's willingness to perform safety behaviors, the integrated model comprises appropriate predictors and mediators is considered a feasibly primary attempt.

5.2 CONTRIBUTIONS OF THE STUDY

This study has made several contributions theoretically and practically. First, extended from the well-established S-O-R model, the conceptual models proposed in the current paper are among the primary attempts to explore how the selected multi-aspects of indicators may simultaneously enhance commercial airlines aircrew's safety behaviors. Although airlines have established the inner evaluation mechanism, as well as safety performance record updated by the local authorities to regularly assess aircrew's job performance, it is considered a reactive approach to govern and monitor employees' behavior. By collecting and analyzing aircrew's personal perceptions on the multi-aspects of indicators, and self-assessed safety behaviors, it provides another source of reference to enable airlines proactively apply multiple strategies to motivate aircrew conducting safety

behaviors.

Second, the direct effects which safety motivation has on pilots' safety compliance and safety participation, and upward safety communication's direct effects on flight attendants' both types of safety behaviors have not been reported in the previous research.

Third, although airlines worldwide have been mandated to implement SMS by ICAO since 1th, January, 2009, whether airlines SMS practice may contribute to enhancing employees' willingness toward conducting safety behaviors is lack of academic research analysis. The present paper bridges the gap by providing the empirical data to support the positive linkage between airlines SMS practice and aircrew's safety behaviors.

Forth, with testing the effects of manager's specific leadership styles on aircrew's safety behaviors, the current study expands the application of paternalistic leadership (morality and benevolent leaderships in particular) and goes beyond the existing literature. To the best of the author's knowledge, paternalistic leadership has been majorly applied to examine the effects on employees' job attitude and organizational behaviors, such as organizational citizenship behavior, satisfaction and commitment (e.g. Cheng et al., 2002; Erben and Güneşer, 2008; Pellegrini et al., 2010). This thesis demonstrates that morality leadership and benevolent leadership may also link to employees' safety behaviors.

Fifth, the results of current paper provide the empirical findings of each attribute's influence on aircrew's safety behavior with direct, indirect and total effects. Airlines may well utilize the findings as references to promote safety programs, managerial technique and set up recruiting strategies for human resource management.

5.3 IMPLICATIONS OF THE STUDY

The findings of the current study provide some guidance for airlines to develop strategies for enhancing aircrew's safety behaviors. Airlines should recognize that the work context of aircrews is both teamwork and task oriented, thus individual characteristics, skills and job-related internal environment within an organization all require necessary attention.

Airlines' SMS practice demonstrates the significantly positive and direct effects on both pilots and flight attendants safety behaviors. The finding is consistent to what has been previously proposed by Remawi et al. (2011), which indicates the negative relationship between the implementation of a Safety Management System and the attitudes of employees towards unsafe acts in aviation. It is thus confirmed that airlines SMS practice plays an essential role to motivate aircrew conducting both safety compliance and safety participation. Note that airlines' with an accredited SMS practice may be viewed as obtaining a positive organizational safety culture (Lewis, 2008). From a practical perspective, the practice of an SMS demonstrates the determination of an airline's executives to improve safety, and this can then convey to all employees the importance that their company places on this issue (Hsu et al., 2010), with safety then regarded as a collective responsibility. With the use of an SMS, which aims to integrate the entire organization as one team, following principles that are laid down at the top, it is more likely then aircrew will be motivated to conduct safety behaviors. Thus, airlines are not only obligated but motivated to actively promote SMS activities, such as regularly providing employees' with training programs related to emergency preparedness and response plan, which may involve diverse crew members to interact with each other. Also, including all employees in the SMS promotion by opening multiple accesses to collect the

assessments for the improvement may help encourage them to participate.

As for the group and individual aspects' antecedents, pilots' safety behaviors are found indirectly affected by fleet manager's morality leadership and directly impacted by self-efficacy. Pilots are commonly viewed as highly professional and well trained individuals. The study results imply that pilots are apt to be self-motivated instead of managed to conduct certain work. The observed phenomena shed some light on flight crew's human resource management which airlines Flight Operations Division should pay attention. Certainly a more respectful leadership style will be recommended. Also, with the positive effects which pilots' self-efficacy has on their safety compliance, it is strongly recommended that management techniques should be applied to well utilize the potential advantage of self-efficacy. Earlier research revealed that when people accomplish a goal, their self-efficacy increases, which may lead to the setting of new, more challenging goals (Bandura and Cervone, 1983). For example, breaking goals into manageable steps and establishing a reward system to encourage progressive improvements in performance are expected to have a positive effect on pilots' perceptions of self-efficacy.

Regarding cabin crew's safety behaviors, the research findings contribute to enriching the limited literature concerning flight attendants' safety behaviors and providing some significant managerial implications. With the supervision of benevolent leadership, flight attendants are more likely to conduct upward safety communication and proactive safety behavior. Furthermore, the higher flight attendants evaluate their own CSE, the more likely it is that they will conduct upward safety communication, comply with safety regulations and follow standard operation procedures. The airlines In-flight Service Division should recognize how flight attendants respond to the department manager's benevolent leadership and endeavor to provide cabin crew a supportive, protective and caring working

environment. Some feasible mechanics, such as forming a family-like system to divide huge amount of flight attendants into groups, designating senior employees to be the group head to offer personal concern and regularly holding some activities to enhance cabin crew's belongingness toward the groups. Flight attendants are expected to response with positive feedback when they sense the individual needs and opinions to be valued.

Meanwhile, the critical mediating role of upward safety communication deserves special attention. Cabin crew's willingness to conduct upward safety communication indicates their perceptions of communication friendly working environment, and it may benefit airlines enormously if flight attendants take the initiative to provide invaluable recommendations based on the practical working experience. Previous research indicated that until a company is willing to hear the true voices of its employees regarding the strengths and weaknesses of its existing safety program, accidents may never be completely eliminated (Kennedy, 2007). It is expected that airlines continuously devote effort to develop a free and open safety communication environment where employees may raise concerns and discuss safety related issues. Furthermore, asserting the accessibilities of multiple reporting system, either confidential or named, and rewarding employees with conducting safety communication to enhance proactive safety behavior both quantitatively and qualitatively.

5.4 LIMITATIONS OF THE STUDY

This study has developed two integrated models respectively to identify the linkages among the selective predictors, mediators and aircrew's safety behaviors. Despite the strengths of this work, several limitations should be considered. First, regarding airlines SMS practice and aircrew's safety behavior, the evaluations of the performance in practice

are considered the most objective data. However, due to the limited accessibility to obtain those information, as well as cross-level data, the research results are mainly illustrated by analyzing the quantitative data collected within a couple of months from the self-administrated questionnaires filled out by pilots and flight attendants. Although Harman's single-factor test and partial correlation procedure analysis have been applied to posttest the common method variance, and the results indicating less significant impact, the consequence of common method bias may still exist and should be taken into concern.

Second, applying one antecedent to represent each organizational, group and individual aspects predictors is recognized as the preliminary approach to building a model with tri-aspect factors. The moderate values of path coefficients obtained in this work suggest a limitation to the proposed models.

Third, the positive effect which morality leadership has on multiple types of employees' organizational behavior (e.g. Chu and Hung, 2009; Chou et al., 2005) does not duplicate in the current study between it and pilots' safety behaviors. Besides, department managers' benevolent leadership does not show significantly positive effect on cabin crew's safety compliance, which is also viewed as in-role safety behavior. The aforementioned insignificant linkages found in both models still require further examination to obtain deeper understandings of the related phenomena.

Fourth, the research population of the current study is limited to the aircrews working for five major Taiwanese international airlines. However, the numbers of valid samples from each airline are not equivalent. Furthermore, the prearranged agreement with the airlines representatives to conduct the study specifies that the comparison among five airlines individual research findings will not be practiced. Thus the diversity among the five targeted airlines is beyond discussion in the present paper.

Fifth, since the research population majorly targets at local aircrew members working for Taiwanese international airlines, the results of this study are mainly restricted to the situation of aircrew members with similar cultural background.

5.5 DIRECTIONS FOR FUTURE RESEARCH

The limitations addressed in section 5.4 have provided some directions for future studies. First, although the intrinsic job characteristics of aircrew and airlines current policies discourage the distributions of survey questionnaires, it still deserves efforts to undertake a cross-level investigation, which may provide more thorough insights into how organizational, group and individual predictors may have an interacting influence on pilots and flight attendants safety behaviors. In addition, on the premise if all data are collected from single source, a number of prearranged measures can be taken to ameliorate the problem of common method bias. Using a "marker variable" to partial out common method variance among the model constructs (Lindell and Whitney, 2001) is one of the widely adopted approaches. Separation approach of data collecting (e.g. converting demographic data to use as independent variables) and design approach of instrument developing (e.g. increasing reversed items) are also applicable (Peng et al., 2006; Podsakoff et al., 2003).

Second, future research may apply the proposed conceptual model to examine the hypothesized relationships in other airline professional crews (e.g. maintenance crew) to expand its application. Besides, developing a more comprehensive model with multiple factors representing various aspects indicators should be the next approach. More specifically, diverse leadership styles are recommended to examine the possible impact on aircrew's safety behavior, while individual's personalities, attitude and safety knowledge

are viewed as appropriate independent variables. In addition, it is appropriately to adopt individual characters (regarded as internal stimuli in the current study) as moderators to investigate how they may affect the relationship between external stimuli and cabin crew's safety behavior.

Third, future empirical research of the airlines professional crews' safety behaviors may consider applying longitudinal research design to observe how the impacts of the multi-antecedents change over time.

Fourth, researchers may reach for support from the local authorities for the access of collecting samples on a large scale and comparing the variances among each airline to obtain more thorough insights instead of providing an overview related to the present research subject in practice.

Last but not least, since airlines operate international transportation business, pilots and flight attendants constantly face people with diverse cultural background. An investigation of multi-national context may provide valuable contributions to this domain.

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Appendix1. Flight Crew Safety Behavior Survey Questionnaire (English Version)

Dear flight crew members:

This questionnaire is designed for exploring the multi-factors which may predict flight crew's safety motivation and behavior. It is for academic research only and all of the personal information will be confidential. Please kindly answer all items and feel free to contact us if you have any question. We highly appreciate your precious time and many thanks for the assistance.

National Cheng Kung University
Professor：Dr. Chen, Ching-Fu
Ph. D candidate：Chen, Shu-Chuan

PART I. Please <u>circle the number</u> which best presents your perceptions on the following statements.

Section1. Your evaluation on the practice of company's Safety Management System (SMS)		**Strongly Disagree**						**Strongly Agree**
1	The company continuously improves the SMS practice.	1	2	3	4	5	6	7
2	The company develops precise standard to monitor and evaluate the SMS practice.	1	2	3	4	5	6	7
3	The company's internal reporting channel is highly accessible.	1	2	3	4	5	6	7
4	The top management participates in SMS related activities.	1	2	3	4	5	6	7
5	The top management has clearly stated its determination to execute SMS, even in periods when the company is not growing.	1	2	3	4	5	6	7
6	The management handles safety related issues following the principles of fairness and justice.	1	2	3	4	5	6	7
7	The top management declares its commitment to safety in formal documents.	1	2	3	4	5	6	7
8	The company establishes emergency preparedness and response plans with clear procedures and based on the principle of individual responsibility.	1	2	3	4	5	6	7
9	Employees periodically take training programs related to emergency preparedness and response plans.	1	2	3	4	5	6	7
10	Employees are acquainted with the emergency preparedness procedures and response plans.	1	2	3	4	5	6	7
11	The company periodically runs drills to practice the emergency preparedness procedures and response plans.	1	2	3	4	5	6	7
12	Managers order clear commands for SMS operations.	1	2	3	4	5	6	7
13	The contents of the SMS manual are readily understood.	1	2	3	4	5	6	7
14	The intranet system can precisely save, secure and trace the information.	1	2	3	4	5	6	7
15	An intranet system is used as the platform to share SMS related information.	1	2	3	4	5	6	7
16	SMS related documents are preserved and continuously updated in a standardized format.	1	2	3	4	5	6	7
17	The company establishes a simple and unified standard for safety behavior.	1	2	3	4	5	6	7
18	Employees upgrade their self-managed abilities to conduct safety behavior through the training programs.	1	2	3	4	5	6	7
19	Employees learn comprehensive concepts related to SMS through the training programs.	1	2	3	4	5	6	7

		Strongly Disagree						Strongly Agree
20	The company continuously provides employees with safety related training programs.	1	2	3	4	5	6	7
21	Employees know the correct way to execute SMS through the training programs.	1	2	3	4	5	6	7
22	The company provides diverse training programs (e.g. lectures, workshops, and group activities).	1	2	3	4	5	6	7
23	The company holds SMS promotion activities regularly.	1	2	3	4	5	6	7
Section 2. Leadership style performed by the fleet manager		**Strongly Disagree**						**Strongly Agree**
1	My supervisor is an upright and honest person; he/she never promotes his/her private interests under the guise of serving the public.	1	2	3	4	5	6	7
2	My supervisor treats his staff very fair.	1	2	3	4	5	6	7
3	My supervisor does not use personal relationships or back-door practices to obtain illicit personal gains.	1	2	3	4	5	6	7
4	My supervisor sets himself/ herself a good role model to follow.	1	2	3	4	5	6	7
5	My supervisor always practices what he preaches.	1	2	3	4	5	6	7
Section 3. The degree of self-efficacy		**Strongly Disagree**						**Strongly Agree**
1	I can always manage to solve difficult problems if I try hard enough.	1	2	3	4	5	6	7
2	If someone opposes me, I can find the means and ways to get what I want.	1	2	3	4	5	6	7
3	It is easy for me to stick to my aims and accomplish my goals.	1	2	3	4	5	6	7
4	I am confident that I could deal efficiently with unexpected events.	1	2	3	4	5	6	7
5	Thanks to my resourcefulness, I know how to handle unforeseen situations.	1	2	3	4	5	6	7
6	I can solve most problems if I invest the necessary effort.	1	2	3	4	5	6	7
7	I can remain calm when facing difficulties because I can rely on my coping abilities.	1	2	3	4	5	6	7
8	When I am confronted with a problem, I can usually find several solutions.	1	2	3	4	5	6	7
9	If I am in trouble, I can usually think of a solution.	1	2	3	4	5	6	7
10	I can usually handle whatever comes my way.	1	2	3	4	5	6	7
Section 4. Safety motivation and behavior		**Strongly Disagree**						**Strongly Agree**
1	I feel that it is worthwhile to put in effort to maintain or improve my personal safety.	1	2	3	4	5	6	7
2	I feel that it is important to maintain safety at all times.	1	2	3	4	5	6	7
3	I believe that it is important to reduce the risk of accidents and incidents in the workplace.	1	2	3	4	5	6	7
4	I pay full attention to the pre-flight briefing to collect sufficient data for every flight.	1	2	3	4	5	6	7
5	I use the correct safety procedures for carrying out my job.	1	2	3	4	5	6	7
6	I ensure the highest level of safety when I carry out my job.	1	2	3	4	5	6	7

		Strongly Disagree						Strongly Agree
7	I take the initiative to promote the Safety Management System (SMS) program within the organization.	1	2	3	4	5	6	7
8	I put in extra effort to improve the flight safety.	1	2	3	4	5	6	7
9	I voluntarily carry out tasks or activities that help improve flight safety.	1	2	3	4	5	6	7

PART II. Demographical Information

1. Gender：☐ Male ☐ Female

2. Age：☐ 25－29 ☐ 30－34 ☐ 35－39 ☐ 40－49 ☐ 50－59 ☐ over 60

3. Years of tenure (working for the current company):

☐ 1－5 ☐ 6－10 ☐ 11－15 ☐ 16－20 ☐ 21－25 ☐ 26－30 ☐ 31－35

☐ more than 36

4. Total flight hours：

☐ 0－1,000 ☐ 1,001－2,000 ☐ 2,001－3,000 ☐ 3,001－5,000 ☐ 5,001－7,000

☐ 7,001-10,000 ☐ 10,001-15,000 ☐ more than 15000

5. Position

☐ Check Pilot ☐ Instructor Pilot ☐ Captain ☐ First officer

6. Marital Status

☐ Married ☐ Single

7. Training Background

☐ Self-paid CPL ☐ Company-paid CPL ☐ Air-force ☐ Foreign pilot

Thank you again for completing the survey. Please kindly review all questions to prevent missing data.

Appendix 2. 機師安全行為問卷中文版

敬愛的民航機師，您好：

這份問卷為成功大學交通管理科學研究所的學術研究調查，主要目的是探究能夠預測機師安全行為的整合性因素。您的意見對本研究的進行與完成十分重要，請依照您的實際感受填答。本問卷僅供學術研究使用，個人資料絕不對外公開。如果您有任何問題，歡迎隨時與我們聯繫。

成功大學交通管理科學研究所
指導教授：陳勁甫博士
博士候選人：陳淑娟　敬上

第一部分、請您針對以下各項陳述，<u>圈選</u>出最能反映您看法的數字。

一、評量貴公司安全管理系統(Safety Management System, SMS)的執行成效		**非常不同意**						**非常同意**
1	公司持續改善安全管理系統的推動執行。	1	2	3	4	5	6	7
2	公司設定簡單明確的安全管理系統執行績效評量標準	1	2	3	4	5	6	7
3	公司內部設有可及性高的通報管道	1	2	3	4	5	6	7
4	高層主管以實際行動持續參與安全管理系統的執行工作	1	2	3	4	5	6	7
5	即使獲利狀況不如預期，高層主管仍宣示支持執行安全管理系統的決心	1	2	3	4	5	6	7
6	管理階層秉持公正文化的原則處理安全管理相關事宜	1	2	3	4	5	6	7
7	高層主管以書面化方式，具體揭示公司之安全承諾	1	2	3	4	5	6	7
8	公司制訂權責分明、流程清晰的緊急應變計劃	1	2	3	4	5	6	7
9	員工定期接受緊急應變計劃的相關訓練	1	2	3	4	5	6	7
10	員工熟悉緊急應變計劃的流程步驟	1	2	3	4	5	6	7
11	公司定期舉行緊急應變計劃的演練	1	2	3	4	5	6	7
12	單位主管下達清楚簡明的安全管理系統執行指令	1	2	3	4	5	6	7
13	公司安全管理系統的文件手冊，內容簡明易懂	1	2	3	4	5	6	7
14	公司內部資訊系統可正確無誤地執行存檔及保密工作	1	2	3	4	5	6	7
15	公司建立資訊互享的內部網路系統	1	2	3	4	5	6	7
16	推行安全管理系統的相關文件或活動紀錄，公司制訂統一格式整理保存及持續更新	1	2	3	4	5	6	7
17	公司制訂簡明統一的安全行為規範	1	2	3	4	5	6	7
18	員工經由課程訓練後，可提升安全行為的自我管理能力	1	2	3	4	5	6	7
19	員工可自訓練課程中，瞭解安全管理系統的全貌	1	2	3	4	5	6	7
20	公司提供員工持續性的安全相關課程及訓練	1	2	3	4	5	6	7
21	員工可自訓練課程中，瞭解安全管理系統的執行方式	1	2	3	4	5	6	7

		非常不同意					**非常同意**
22	課程訓練採取多元化方式進行(如: 課堂講授、團隊活動、工作坊……)	1	2	3	4	5	6	7
23	公司定期舉辦宣導安全管理系統的活動	1	2	3	4	5	6	7
二、機隊經理的領導模式		**非常不同意**					**非常同意**
1	他為人正派，不會假公濟私	1	2	3	4	5	6	7
2	他對待我們公正無私	1	2	3	4	5	6	7
3	他不會因為個人的利益去拉關係、走後門	1	2	3	4	5	6	7
4	他是我做人做事的好榜樣	1	2	3	4	5	6	7
5	他能夠以身作則	1	2	3	4	5	6	7
三、自我效能		**非常不同意**					**非常同意**
1	如果我盡力去做，總是可以解決問題	1	2	3	4	5	6	7
2	即使他人反對，我仍然有辦法取得我想要的	1	2	3	4	5	6	7
3	對我來說，堅持理想和達成目標是輕而易舉的	1	2	3	4	5	6	7
4	我有自信可以應付突如其來的事情	1	2	3	4	5	6	7
5	以我的才智，可以應付意料之外的狀況	1	2	3	4	5	6	7
6	只要付出必要的努力，我可以解決大多數的難題	1	2	3	4	5	6	7
7	我可以冷靜面對困難，因為我信賴自己處理問題的能力	1	2	3	4	5	6	7
8	面對問題時，我通常能找到數種解決方法	1	2	3	4	5	6	7
9	有麻煩時，我通常能想到一些應付的方法	1	2	3	4	5	6	7
10	無論發生甚麼事，我都能應付自如	1	2	3	4	5	6	7
四、安全動機與行為		**非常不同意**					**非常同意**
1	我覺得努力維護或增進個人安全是值得做的	1	2	3	4	5	6	7
2	我覺得隨時維持安全狀態是重要的	1	2	3	4	5	6	7
3	我相信減少意外事故風險是重要的	1	2	3	4	5	6	7
4	我會全神貫注地在飛行前的簡報中，收集所有需要的飛航情報	1	2	3	4	5	6	7
5	工作時，我會採用正確的安全步驟	1	2	3	4	5	6	7
6	工作時，我會確保最高程度的安全狀態	1	2	3	4	5	6	7
7	我會推廣公司的安全管理系統(SMS)計劃	1	2	3	4	5	6	7
8	我會為提升飛航安全付出額外心力	1	2	3	4	5	6	7
9	我會主動參與執行提升飛航安全的工作或活動	1	2	3	4	5	6	7

第二部份、受訪者基本資料

1. 您的性別：	□男 □女
2. 您的年齡：	□25-29 歲 □30-34 歲 □35-39 歲 □40-49 歲 □50-59 歲 □60 歲以上
3. 您的年資(目前任職公司)：	□1-5 年 □ 6-10 年 □11-15 年 □16-20 年 □21-25 年 □26-30 年 □31-35 年 □36 年以上
4. 您的飛行總時數：	□0-1,000 □1,001-2,000 □2,001-3,000 □3,001-5,000 □5,001-7,000 □7,001-10,000 □10,001-15,000 □15,000 以上
5. 您的職務：	□檢定機師 □教練機師 □正機師 □副機師
6. 您的婚姻狀況：	□已婚 □單身
7. 您的基礎飛行訓練背景：	□自訓 □公司培訓 □ 軍退 □外籍

問卷至此全部結束，煩請您再檢查一遍，以免遺漏您寶貴的意見，
再次感謝您的協助！

Appendix3. Cabin Crew Safety Behavior Survey Questionnaire (English Version)

Dear cabin crew members:

This questionnaire is designed for exploring the multi-factors which may predict flight attendants' upward safety communication and behavior. It is for academic research only and all of the personal information will be confidential. Please kindly answer all items and feel free to contact us if you have any question. We highly appreciate your precious time and many thanks for the assistance.

National Cheng Kung University

Professor：Dr. Chen, Ching-Fu

Ph. D candidate：Chen, Shu-Chuan

PART I. Please <u>circle the number</u> which best presents your perceptions on the following statements.

Section1. Your evaluation on the practice of company's Safety Management System (SMS)		**Strongly Disagree**						**Strongly Agree**
1	The company continuously improves the SMS practice.	1	2	3	4	5	6	7
2	The company develops precise standard to monitor and evaluate the SMS practice.	1	2	3	4	5	6	7
3	The company's internal reporting channel is highly accessible.	1	2	3	4	5	6	7
4	The top management participates in SMS related activities.	1	2	3	4	5	6	7
5	The top management has clearly stated its determination to execute SMS, even in periods when the company is not growing.	1	2	3	4	5	6	7
6	The management handles safety related issues following the principles of fairness and justice.	1	2	3	4	5	6	7
7	The top management declares its commitment to safety in formal documents.	1	2	3	4	5	6	7
8	The company establishes emergency preparedness and response plans with clear procedures and based on the principle of individual responsibility.	1	2	3	4	5	6	7
9	Employees periodically take training programs related to emergency preparedness and response plans.	1	2	3	4	5	6	7
10	The contents of the SMS manual are readily understood.	1	2	3	4	5	6	7
11	The company establishes a simple and unified standard for safety behavior.	1	2	3	4	5	6	7
12	Employees upgrade their self-managed abilities to conduct safety behavior through the training programs.	1	2	3	4	5	6	7
13	Employees learn comprehensive concepts related to SMS through the training programs.	1	2	3	4	5	6	7
14	The company continuously provides employees with safety related training programs.	1	2	3	4	5	6	7
15	Employees know the correct way to execute SMS through the training programs.	1	2	3	4	5	6	7
16	The company provides diverse training programs (e.g. lectures, workshops, and group activities).	1	2	3	4	5	6	7
17	The company holds SMS promotion activities regularly.	1	2	3	4	5	6	7

Section 2. Leadership style performed by the department manager		**Strongly Disagree**						**Strongly Agree**
1	Beyond work relations, my supervisor expresses concern about my daily life.	1	2	3	4	5	6	7
2	My supervisor ordinarily shows a kind concern for my comfort.	1	2	3	4	5	6	7
3	My supervisor will help me when I'm in an emergency.	1	2	3	4	5	6	7
4	My supervisor takes very thoughtful care of subordinates who have spent a long time with him/her.	1	2	3	4	5	6	7
5	My supervisor takes good care of my family members as well.	1	2	3	4	5	6	7
Section 3. The degree of core self-evaluations		**Strongly Disagree**						**Strongly Agree**
1	I am confident that I can get the success I deserve in life.	1	2	3	4	5	6	7
2	Sometimes I feel depressed.	1	2	3	4	5	6	7
3	When I try, I generally succeed.	1	2	3	4	5	6	7
4	Sometimes when I fail I feel worthless.	1	2	3	4	5	6	7
5	I complete tasks successfully.	1	2	3	4	5	6	7
6	Sometimes, I do not feel in control of my work.	1	2	3	4	5	6	7
7	Overall, I am satisfied with myself.	1	2	3	4	5	6	7
8	I am filled with doubts about my competence.	1	2	3	4	5	6	7
9	I determine what will happen in my life.	1	2	3	4	5	6	7
10	I do not feel in control of my success in my career.	1	2	3	4	5	6	7
11	I am capable of coping with most of my problems.	1	2	3	4	5	6	7
12	There are times when things look pretty bleak and hopeless to me.	1	2	3	4	5	6	7
Section 4. Upward safety communication and safety behavior		**Strongly Disagree**						**Strongly Agree**
1	I'd like to propose suggestions regarding safety issues.	1	2	3	4	5	6	7
2	I feel comfortable discussing safety behavior with my supervisor.	1	2	3	4	5	6	7
3	I try to avoid talking about safety issues with my supervisor.	1	2	3	4	5	6	7
4	I feel that my supervisor openly accepts ideas for improving safety.	1	2	3	4	5	6	7
5	I am reluctant to discuss safety-related problems with my supervisor.	1	2	3	4	5	6	7
6	I feel that my supervisor encourages open communication about safety.	1	2	3	4	5	6	7
7	During ground check, I will make sure all emergency equipment has been well-loaded.	1	2	3	4	5	6	7
8	I use the correct safety procedures for carrying out my job.	1	2	3	4	5	6	7
9	I ensure the highest level of safety when I carry out my job on board.	1	2	3	4	5	6	7
10	I promote the safety program within the organization.	1	2	3	4	5	6	7
11	I put in extra effort to improve the safety on board.	1	2	3	4	5	6	7
12	I voluntarily carry out tasks or activities that help improve cabin safety.	1	2	3	4	5	6	7

PART II. Demographical Information

1. Gender：☐ Female □ Male

2. Age：☐ Below 25 ☐ 26－30 ☐ 31－35 ☐ 36－40 ☐ Over 41

3. Years of tenure (working for the current company):

☐ Less than 1 year ☐ 1－5 ☐ 6－10 ☐ 11－15 ☐ 16－20 ☐ More than 21 years

4. Average flight time within previous three months：

☐ Less than 70 hours ☐ 70－80 hours ☐ 81－100 hours ☐ More than 100 hours

5. Position

☐ Flight Attendant ☐ Deputy Purser ☐ Chief Purser

6. Marital Status

☐ Married ☐ Single

7. Number of Children

☐ None ☐ 1 Child ☐ 2 Children ☐ 3 Children or More

Thank you again for completing the survey. Please kindly review all questions to prevent missing data.

Appendix 4. 空服員安全行為問卷中文版

敬愛的空服組員，您好：

這份問卷為成功大學交通管理科學研究所的學術研究調查，主要目的是探究能夠預測空服員安全行為的整合性因素。您的意見對本研究的進行與完成十分重要，請依照您的實際感受填答。本問卷僅供學術研究使用，個人資料絕不對外公開。如果您有任何問題，歡迎隨時與我們聯繫。

成功大學交通管理科學研究所
指導教授：陳勁甫博士
博士候選人：陳淑娟　敬上

第一部分、請您針對以下各項陳述，圈選出最能反映您看法的數字。

一、評量貴公司安全管理系統(Safety Management System, SMS)的執行現況		**非常不同意**						**非常同意**
1	公司持續改善安全管理系統的推動執行。	1	2	3	4	5	6	7
2	公司設定簡單明確的安全管理系統執行績效評量標準	1	2	3	4	5	6	7
3	公司內部設有可及性高的通報管道	1	2	3	4	5	6	7
4	高層主管以實際行動持續參與安全管理系統的執行工作	1	2	3	4	5	6	7
5	即使獲利狀況不如預期，高層主管仍宣示支持執行安全管理系統的決心	1	2	3	4	5	6	7
6	管理階層秉持公正文化的原則處理安全管理相關事宜	1	2	3	4	5	6	7
7	高層主管以書面化方式，具體揭示公司之安全承諾	1	2	3	4	5	6	7
8	公司制訂權責分明、流程清晰的緊急應變計劃	1	2	3	4	5	6	7
9	員工定期接受緊急應變計劃的相關訓練	1	2	3	4	5	6	7
10	公司定期舉行緊急應變計劃的演練	1	2	3	4	5	6	7
11	公司安全管理系統的文件手冊，內容簡明易懂	1	2	3	4	5	6	7
12	員工經由課程訓練後，可提升安全行為的自我管理能力	1	2	3	4	5	6	7
13	員工可自訓練課程中，瞭解安全管理系統的全貌	1	2	3	4	5	6	7
14	公司提供員工持續性的安全相關課程及訓練	1	2	3	4	5	6	7
15	員工可自訓練課程中，瞭解安全管理系統的執行方式	1	2	3	4	5	6	7
16	課程訓練採取多元化方式進行(如: 課堂講授、團隊活動、工作坊……)	1	2	3	4	5	6	7
17	公司定期舉辦宣導安全管理系統的活動	1	2	3	4	5	6	7
二、部門主管的領導模式		**非常不同意**						**非常同意**
1	他會關懷我私人的生活起居	1	2	3	4	5	6	7
2	他平常會對我噓寒問暖	1	2	3	4	5	6	7

		非常不同意						非常同意
3	我有急難時，他會及時伸出援手	1	2	3	4	5	6	7
4	對相處較久的部屬，他會給予無微不至的照顧	1	2	3	4	5	6	7
5	他對我的照顧會擴及到我的家人	1	2	3	4	5	6	7
三、核心自我評量		**非常不同意**						**非常同意**
1	我有自信，我能獲取人生中所應得的勝利。	1	2	3	4	5	6	7
2	有時我會覺得意志消沉。	1	2	3	4	5	6	7
3	當我付出努力時，通常都會成功	1	2	3	4	5	6	7
4	受到挫折時，我覺得自己一無是處	1	2	3	4	5	6	7
5	我可以成功地完成任務。	1	2	3	4	5	6	7
6	有時候，我會覺得無法掌控工作的進展	1	2	3	4	5	6	7
7	大體來說，我對自己是滿意的	1	2	3	4	5	6	7
8	我對自己的能力充滿懷疑。	1	2	3	4	5	6	7
9	我的人生由我自己掌握。	1	2	3	4	5	6	7
10	我無法掌控工作上能有多少成就	1	2	3	4	5	6	7
11	我有能力處理大多數所遭遇的問題	1	2	3	4	5	6	7
12	有時我會覺得人生淒涼無助	1	2	3	4	5	6	7
四、向上安全溝通與安全行為		**非常不同意**						**非常同意**
1	我願意提出安全相關之改善建議	1	2	3	4	5	6	7
2	我可以自在地和主管討論安全行為的相關議題。	1	2	3	4	5	6	7
3	我試著避免和主管談論有關安全的議題	1	2	3	4	5	6	7
4	我覺得部門主管可以欣然接受改善安全的意見	1	2	3	4	5	6	7
5	我不願意和主管討論任何有關安全的問題。	1	2	3	4	5	6	7
6	我覺得主管鼓勵公開討論安全議題	1	2	3	4	5	6	7
7	地面檢查時，我會確認機上已備妥所有緊急逃生用品	1	2	3	4	5	6	7
8	我會確實遵照規定的步驟執行安全檢查及服務工作	1	2	3	4	5	6	7
9	工作時，我會確保機艙內處於最高程度的安全狀態	1	2	3	4	5	6	7
10	我會推廣公司的安全計劃	1	2	3	4	5	6	7
11	我會為提升客艙安全付出額外心力	1	2	3	4	5	6	7
12	我會主動參與執行提升客艙安全的工作或活動	1	2	3	4	5	6	7

第二部份、受訪者基本資料

1.	您的性別：	□女 □男
2.	您的年齡：	□25 歲以下 □26-30 歲 □31-35 歲 □36-40 歲 □40 歲以上
3.	您的年資(目前任職公司)：	□1 年以下 □ 1-5 年 □6-10 年 □11-15 年 □16-20 年 □20 年以上
4.	近三個月的每月平均飛行時數：	□70 小時以下 □70-80 小時 □ 80-100 小時 □100 小時以上
5.	您的職級：	□ 空服員 □ 副事務長 (副座艙長) □ 事務長 (座艙長)
6.	您的婚姻狀況：	□已婚 □單身
7.	您的子女數：	□ 無 □1 名 □ 2 名 □3 名(含以上)

問卷至此全部結束，煩請您再檢查一遍，以免遺漏您寶貴的意見，
再次感謝您的協助！

CURRICULUM VITAE

Personal details

- 姓名：陳淑娟
- **Name: Shu-Chuan Chen**

Educations

- **PhD in the Department of Transportation and Communication Management Science, National Cheng Kung University, 2009/09~2013/12**
- **Master in the Department of Educational Technology, University of San Francisco, 2000/10~2002/05**
- **Bachelor in the Department of Chinese Literature, National Sun Yat-sen University, 1985/10~1989/06**

Experiences

- **Assistant Professor, Department of Air Transportation Management, Aletheia University, 2012/02~present**
- **Lecture, Department of Air Transportation Management, Aletheia University, 2004/09~2012/01**
- **Cabin Crew Instructor, EVA Airways, 1993~2000**
- **Chief Purser, EVA Airways, 1991~2000**
- **Flight Attendant, EVA Airways, 1990~1991**

Publication List

a. Journal Paper

1. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Investigating the Effects of Job Demands and Job Resources on Cabin Crew Safety Behaviors," Journal of Tourism Management, Vol. 41, 2014, pp. 45-52. (SSCI)

2. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Measuring the Effects of Safety Management System Practice, Morality Leadership and Self-efficacy on Pilot Safety Behavior：Safety Motivation as a Mediator," Safety Science, Vol. 62, 2014, pp. 376-385. (SCI)

3. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Investigating the Effects of Safety Management System Practice, Benevolent Leadership and Core Self-evaluations on Cabin Crew Safety Behaviors", Asia Transport Study. (accepted).

4. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Scale Development of Safety Management System Evaluation for the Airline Industry," Accident Analysis & Prevention. Vol. 47, 2012, pp. 177-181. (SSCI)

5. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Burnout and Work Engagement among Cabin Crew: Antecedents and Consequences," International Journal of Aviation Psychology, Vol. 22, No. 1, 2012, pp. 41-58. (SSCI)

b. Conference Paper

1. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Upward Safety Communication and Safety Behavior of Cabin Crew" 10th Eastern Asia Society for Transportation Studies Conference, Taipei, Taiwan, Sep. 09-12, 2013. Awarded the best paper for discovering the interesting facts.
2. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), "Exploring the Effects of Job Demands and Job Resources on Cabin Crew Safety Behaviors," 17th Annual Air Transport Research Society World Conference, Bergamo, Italy, June 26-29, 2013.

3. Chen, Shu-Chuan and Chen, Ching-Fu, “The Impact of Safety Management System, Morality Leadership and Self Efficacy on Pilots' Safety Behavior,” 16th Annual Air Transport Research Society World Conference, Tainan, Taiwan, June 27-30, 2012.

4. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), “Scale Development of Safety Management System Evaluation in Airline Industry,” 15th Annual Air Transport Research Society World Conference, Sydney, Australia, June 29-July 2, 2011.

5. Chen, Shu-Chuan, Chen, Ching-Fu, and Kuo, Shih-Yao, “The Effect of Service Quality, Satisfaction, and Brand Equity on Air Passengers’ Behavioral Intentions,” 15th Annual Air Transport Research Society World Conference, Sydney, Australia, June 29-July 2, 2011.

6. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), “Perception Gaps in the Execution of Safety Management System - A Case Study of the Airline Industry,” 9th Eastern Asia Society for Transportation Studies Conference, Jeju, Korea, June 20-23, 2011.

7. Chen, Ching-Fu and Chen, Shu-Chuan (correspondence author), “Burnout and Work Engagement among Taiwanese Flight Attendants: the Application of Job Demands-Resources Model,” 12th World Conference on Transport Research, Lisbon, Portugal, July 11-15, 2010.