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Organizational Safety Culture And Idividual Safety Behavior: A Case Study Of The Turkish National Police Aviation Department

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ORGANIZATIONAL SAFETY CULTURE AND INDIVIDUAL SAFETY BEHAVIOR: A CASE STUDY OF THE TURKISH NATIONAL POLICE AVIATION DEPARTMENT

by

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ABSTRACT

Human related accidents in high-risk industries amount to a significant economic hazard and incur tremendous damages, causing excessive operational costs and loss of life. The aviation industry now observes human-related accidents more frequently than in the past, an upswing attributable to cutting-edge technology usage and the complex systems employed by aviation organizations. Historically, aviation accidents have been attributed to individual unsafe behavior. However, contemporary accident causation models suggest that organizational-level factors influence individual safety performance, as human-related accidents take place in an organizational context.

The present study examines the formation of organizational safety culture and influence on individuals' safety behavior in a police aviation environment. The theory of planned behavior guides the study model in explaining individual variability in safety behavior via organizational safety culture. The study conceptualized organizational safety culture and individual safety behavior as multidimensional constructs. Confirmatory factor analysis was conducted for each latent construct to validate the construct validity for each measurement model. Organizational safety culture was observed via safety climate facets, which contained four subcomponents including individual attitude, group norms, management attitude, and workplace pressures. Individual safety behavior contained violation and error components observed by self-reported statements. Structural equation modeling was conducted to test the study hypotheses. Utilizing a sample of 210 employees from the Turkish National Police Aviation Department, a 53-item survey was conducted to measure individuals' safety culture perceptions and self-reported safety behaviors.

The results suggest that individual safety behavior is significantly influenced by organizational safety culture. Except for the relation between workplace pressures and intention, all suggested relations and correlations were statistically significant. The four-factor measurement model of organizational safety climate fit reasonably well to the data, and most correlations between the safety climate components were significant at the .05 level. Individuals' self-reported error behavior is positively associated with age, and individuals' self-reported violation behavior is positively associated with years of service. Overall, along with organizational safety culture, age and service-year variables accounted for 65% of the variance in intention, 55% of the variance in violation behavior, and 68% of the variance in error behavior. Lastly, no significant difference manifested among pilots, maintenance personnel, and office staff according to their self-related safety behaviors.

The findings have theoretical, policy, and managerial implications. First, the theory of planned behavior was tested, and its usefulness in explaining individuals' safety behavior was demonstrated. The survey instrument of the study, and multi-dimensional measurement models for organizational safety climate and individual safety behavior were theoretical contributions of the study. Second, the emergence of informal organizational structures and their effects on individuals indicated several policy implications. The study also revealed the importance of informal structures in organizations performing in high-risk environments, especially in designing safety systems, safety policies, and regulations. Policy modification was suggested to overcome anticipated obstacles and the perceived difficulty of working with safety procedures. The influences of age on error behavior and years of service on violation behavior point to the need for several policy modifications regarding task assignment, personnel recruitment, health

reports, and violation assessment policies. As well, managerial implications were suggested, including changing individuals' perceptions of management and group attitudes toward safety. The negative influence of anticipated obstacles and the perceived difficulties of safety procedures on individual safety behavior pointed out management's role in reducing risks and accidents by designing intervention programs to improve safety performance, and formulating proactive solutions for problems typically leading to accidents and injuries.

This dissertation is dedicated to the beautiful people of my country, Turkey.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS/ACRONYMS

AGFI	Adjusted Goodness of Fit Index
AMOS	Analysis of Moment Structure
CN	Hoelter's Critical N
C.R.	Critical Ratio
DF	Degrees of Freedom
GFI	Goodness of Fit Index
N or n	Number of subjects
NFI	Norma Fit Index
P	Probability
RMSEA	Root Mean Square Error of Approximation
S.E.	Standard Error
SEM	Structural Equation Model
SPSS	Statistical Package for the Social Sciences
S.R.W.	Standardized Regression Weights
TNP	Turkish National Police Organization
TLI	Tucker Lewis Index
U.R.W.	Unstandardized Regression Weight

CHAPTER 1 INTRODUCTION

1.1 Statement of the Problem

Organizational influence on individual behavior is an important area in high-risk industries because human-related accidents take place in an organizational context (Maurino, Reason, Johnston, & Lee, 1995). An example of a high-risk industry is the aviation sector, which has experienced a decrease in machine-related accidents while the frequency of human error has increased due to cutting-edge technology usage and the complex systems involved in aviation organizations (Wiegmann & Shappell, 2003; Shappell et al., 2007). Human-error-related accidents are more common than in the past in the aviation industry (Maurino et al., 1995). Understanding the complex relationship between an established high-risk environment and the individual can help to distinguish organizational criteria that promote high safety reliability and low rates of human error (Helmreich, 1999). This study aims to identify the influence of organizational safety culture on individuals' safety behavior in the police aviation environment.

Human-related accidents in high-risk industries cause significant hazards and tremendous damage, contributing to excessive operational costs and loss of life (Wiegmann & Shappell, 2003). The US National Safety Council (2002) estimated that the total cost of work-related injuries and deaths in 2001 amounted to $132.1 billion and 130 million work days lost. The intangible costs, such as physical suffering and psychological damage to individuals and

families, the diminished ability to perform social roles, and loss of community morale, are not included in this cost. Accident investigators name human error as the major causal factor in 85 percent of all aviation accidents and incidents (Shappell & Wiegmann, 2000; Li, Baker, Grabowski, & Rebok, 2001; Duffey & Saull, 2004; Dekker, 2005). Consequently, work-related injuries cause substantial monetary and personal losses to individuals and communities, as well as to organizations. Historically, the traditional perspective on these losses has focused on individuals and the most recent unsafe behaviors alone, but contemporary human error models emphasize organizational behavior as a latent factor contributing to unsafe behavior in the work environment (Reason, 1990; Wiegmann & Shappell, 2003; Dekker, 2005).

Bird's (1974) domino theory and Reason's (1990) Swiss cheese model of error causation are two examples of contemporary human error models that emphasize the latent factors behind human-related mishaps. Latent factors include preconditions of unsafe acts, unsafe supervision, organizational influences, and social environment. Aviation accidents are the consequence of a series of events, in which the last one, the individual's unsafe action, is an output of these factors (Bird, 1974; Reason, 1990; Helmreich & Merritt, 2001; Wiegmann & Shappell, 2003). Therefore, reducing workplace accidents relies on reducing human error, as more than 85% of industrial accidents have been attributed to unsafe acts committed by an individual (Shappell & Wiegmann, 2000; Dekker, 2005). Unfortunately, these statistics on industrial accidents did not take into consideration the organizational context in which these errors were committed. Further analysis by safety researchers suggests that it is necessary to consider unsafe behavior in collective rather than individual terms (Maurino et al., 1995; Wiegmann & Shappell, 2003). Collective approach addresses human error at not only the individual performing last unsafe act

but it also examines all levels of the system, including the organizational factors and condition of aircrew. The act of focusing on the individual actions that result in human error has been compared to allowing mosquitoes to breed in stagnant water and then focusing on how to swat them away. In contrast, the collective approach offers a method of identifying the organizational factors contributing to unsafe acts. This approach addresses the latent failures that breed errors in an organization by locating the source of the issue—in other words, it first drains the pond where the mosquitoes breed (Maurino et al., 1995), solving the problem at the source.

Organizations performing in high-risk environments must institute high safety reliability standards to mitigate human-related accidents by establishing an organizational safety culture that can positively influence an individual's workplace behavior (Mearns, Flin, Gordon, & Fleming, 2001). However, several studies elaborate on how organizational factors influence employees' safety behavior in the workplace (Griffin & Neal, 2000; Glendon & Litherland, 2001; Neal & Griffin, 2002; Hall, 2006; Shappell et al., 2007; Baron, 2008; Fogarty & Shaw, 2009). Helmreich and Merritt (2001) have traced the national, professional, and organizational factors affecting individuals' safety behavior and determined that safety behaviors in the workplace can be achieved and sustained more successfully with a strong organizational safety culture. Hence, it would be useful to identify the organizational factors that contribute to safe behaviors among employees performing in high-risk industries.

The purpose of this study is to examine the organizational safety culture of the Turkish National Police (TNP) Aviation Department and its subunits, which consists of city units and task groups of pilots, maintenance personnel, and office staff, in order to identify the

organizational determinants of individuals' safety behavior. Police Aviation Units are supportive forces in law enforcement organizations that provide rapid response to life-threatening crimes, accidents, and incidents in progress (Alpert, 1998). The TNP Aviation Department is primarily comprised of several main subgroups: pilots, maintenance personnel, and office staff. The context in which police aviators perform their jobs classifies their activities as high-risk in both law enforcement and aviation. Therefore, determining the organizational factors behind police aviators' safety behavior, as well as sub-group differences, was proposed as a solution that would help reduce human-related accidents and incidents in the workplace. The theoretical premise for this approach, detailed in the literature section, is based primarily in the theory of reasoned behavior, which was selected for this application in order to explain the variability in safety behavior in the workplace (Ajzen, 1991, 2005). This study tests a model proposing that the safety culture of an organization influences the employees' safety behavior. Safety climate, the measurable facet of safety culture, was used to measure the organizational safety culture because of the measurement difficulty involved in assessing safety culture (Cooper & Phillips, 2004). The organizational safety culture was measured by safety climate surveys because climate offers a snapshot of the actual culture (Hall, 2006). Culture, climate, and behavior concepts were elaborately defined in the following section in order to formulate a basis for understanding.

1.2 Definition of Terms

The study is based on several concepts, including organizational safety culture and climate, and safety behavior. *Safety culture* has many definitions within a considerable body of literature; however, researchers have yet to reach a consensus as to the definition of the term

(Shappell & Wiegmann, 2000; Helmreich & Merritt, 2001; Zhang, Wiegmann, von Thaden, Sharma, & Mitchell, 2002). Zhang et al. (2002) aggregated the similarities of safety culture definitions and asserted that the significant aspect of safety culture is a deeply rooted, stable, and therefore dominant attitude toward safety throughout an organization—an attitude extremely resistant to change. As a result, the existing safety culture would have a tremendous influence on individual behavior within the organizational context (Wiegmann, Zhang, von Thaden, Sharma, & Mitchell, 2002). An alternate and more complete definition by Zohar (1980) portrays safety culture as defined by shared perceptions about leaders' commitment to safety, appropriate measures taken to mitigate probable risks, and level of devotion to safety standards and procedures.

This study aims to observe the influence of safety culture on an individual's behavior. Measuring an organization's safety culture can, however, be problematic (Cooper & Phillips, 2004). *Organizational culture* refers to the climate of an organization as a whole, including codes, values, norms, rules, what is expected, and what is valued (Westrum, 1996). Cooper and Phillips (2004) claimed that psychometric safety climate measurement instruments can measure the safety culture construct in a particular time because climate is a measurable facet of organizational culture. Hence, organizational safety culture was observed by its safety climate facet as a latent construct in this study.

Safety climate is regarded as a subcomponent of safety culture (Zohar, 2000) and a snapshot of an organization's actual safety culture (Hall, 2006), as well as a measurable facet of safety culture (Zohar & Luria, 2005). In this study, safety climate stands for the shared

perceptions of employees regarding common attitudes in the workplace toward safety at a particular time (Hall, 2006). Zohar's (1980) definition of safety climate is also useful for this study. He defined safety climate as "a summary of molar perceptions that employees share about their work environments" (Zohar, 1980, p. 96). Then this understanding of safety climate was further clarified as "shared perceptions among members of an organization with regard to aspects of the organizational environment that inform role behavior, that is, the extent to which certain facets of role behavior are rewarded and supported in any organization" (Zohar & Luria, 2005, p. 1). While safety culture is stable and difficult to modify, safety climate is particularly dynamic and subject to change at any time (Wiegmann et al., 2002).

Safety behavior is a notoriously problematic construct because of the variations that occur in defining the term and the difficulty involved in its measurement (Cooper & Phillips, 2004). For the purposes of this study, safety behavior refers to any behavior mode that mitigates the probability of human error (Glendon & Litherland, 2001). This study measures safety behavior based on the self-reported items. Safety behavior, as a dependent variable, is supposed to consist of actual behaviors performed by individuals at the workplace to the extent to which their actions comply with safety procedures (Griffin & Neal, 2000). Wiegmann and Shappell (2003) classified safety behaviors into two categories. While the term *safety violation* refers to willful and conscious disregard of approved safety regulations and procedures, *safety error* refers to situations in which an individual's activities accidentally failing to accomplish intended outcome (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2003).

1.3 Purpose of the Study

The purpose of the study is to explore the organizational determinants of employees' safety behaviors when working in an organization that require a high level of safety. Early studies focused on the individual and the aircraft itself as causal elements of accidents (Maurino et al., 1995; Helmreich & Merritt, 2001; Wiegmann & Shappell, 2001; Shappell et al., 2007). However, contemporary safety studies focus on a collectivist rather than an individual approach to accident causation (Reason, 2000; Dekker, 2005; Wiegmann et al., 2005). Examining the relation between employees' actual safety behavior and employees' perceptions of organizational safety culture will help to avoid human-related accidents in high-risk industries (Helmreich & Merritt, 2001). In high-risk industries, even a small human error may lead to devastating disasters. According to the International Atomic Energy Agency, poor safety culture was a causal and contributing factor in the Chernobyl nuclear accident (Cox & Flin, 1998). In other words, organizational factors have been pinpointed as the latent origin of accidents in high-risk industries. This study focused on the organizational factor of human error and the behavioral patterns that lead to safety incidents. It is, therefore, postulated that the safety culture of an organization influences the safety level of employees' behavior at the workplace.

Establishing an effective safety culture is critical for organizations performing in high-risk industries. Safety culture can reshape and color employees' attitudes and behaviors toward safety in the workplace. Because organizational culture takes time to establish as well as to modify, the existing cultural influence on individuals can be widespread and pervasive (Maurino et al., 1995). Helmreich (1996) emphasized the strength and weaknesses of organizational

culture in shaping individuals’ attitudes and behaviors. Based on this premise, organizations can design and modify their culture by minimizing weaknesses and emphasizing strengths. Hence, identifying the organizational determinants of individuals’ safety behavior can be useful in designing and modifying existing organizational culture.

Organizations performing in high-risk industries have broad Standard Operation Procedures (SOPs) and regulations, in compliance with which employees are expected to perform. Helmreich (1996) stated the importance of cultural factors in the design of SOPs and regulations. Not only aircraft technology, but also SOPs, flight and maintenance checklists, workflow charts, and safety procedures and regulations are designed to accommodate western culture. Countries importing aircraft technology operate their aviation systems regardless of cultural differences (Helmreich & Merritt, 2001), but designing culturally ergonomic aviation systems can help improve the safety performance of individuals and organizations (Cooper & Phillips, 2004). Consequently, this study’s findings can help the police aviation community establish a highly reliable safety culture within the organizational context of the TNP Aviation Department.

Safety culture perceptions vary among subgroups despite the fact that they work in the same organization (Glendon & Litherland, 2001). This study aimed to identify any differences in safety culture perception and safety behavior among subgroups despite their placement in the same organization. The TNP Aviation Department has its headquarters in the capital city and five units in Turkey’s largest regional cities. Three main task groups have responsibilities, including the pilot, maintenance staff, and office staff. Employees vary based on rank, age,

educational level, service years, and flight hours. Exploring the safety behavior differences based on the organizational and demographic characteristics of the TNP Aviation Department members can assist in identifying problematic areas, intervention points, and proactive measures. Hence, the study aimed to explore to what extent TNP Aviation Department members' safety behaviors are influenced by their organizational and demographic characteristics. These factors are critical in identifying compounding factors that can help to isolate the specific differences among employee sub-groups that exist despite their performing in the same organizational workplaces.

1.4 Research Questions

This study focuses primarily on the impact of organizational safety culture on the self-reported safety behavior of members of the TNP Aviation Department, based on the theory of planned behavior. This study seeks answers to the following research questions:

Q_1: What is the organizational influence on the individual's safety behavior in the workplace?

Q_2: What is the relation between organizational safety culture and individuals' safety behaviors?

Q_3: What is the direction and magnitude of the relation between organizational safety culture and individuals' safety behaviors?

Q_4: What is the impact of employees' organizational and demographic characteristics on their self-reported safety performance?

Q_5: Is there any difference among sub-groups in terms of their self-reported safety behaviors?

Q_6: How do the four dimensions of organizational safety culture correlate with each other?

Q_7: Which dimensions of organizational safety culture have strongest impact on individuals' safety behaviors?

1.5 Significance of the Study

This study has theoretical, policy and practical implications. A comprehensive literature review on organizational safety culture, climate, and the safety behavior of employees performing in a high-risk environment is presented to indicate the human factor's role as a vital issue in aviation, medicine, construction, and nuclear plants (Li et al., 2001; Duffey & Saull, 2004). In complex organizations, such as aviation departments, organizational failures are more common than individual errors (Maurino et al., 1995; Mearns et al., 2001). However, there is a shortage of empirical studies to demonstrate theoretical models in this regard (Cooper & Phillips, 2004). Researchers have struggled to demonstrate the relation between organizational safety culture and individuals' safety performance; the relation has not to date been empirically demonstrated (Cooper & Phillips, 2004). This study has the potential to generate useful information about how the safety culture of an organization may influence the actual safety behavior of employees working in high-risk organizations.

Determining the effects of organizational factors on individual safety behavior has practical implications for establishing a strong safety culture in organizations because human-related accidents take place in an organizational context rather than in an isolated area (Maurino et al., 1995; Westrum, 1996). This study has the potential to help establish a strong safety culture in the TNP Aviation Department through an evidence-based analysis of its safety culture, supported by a comprehensive literature review. Because of the rapid development in aircraft technology, machine-related accidents have decreased since World War II, while human-related accidents have increased because of the increased complexity of aircraft systems (Wiegmann & Shappell, 2003). As a consequence, human errors in aviation are more common today than in the past. If employee attitudes and behaviors are shaped by organizational culture, which influences values, beliefs, and behaviors, it can be useful to determine the factors associated with an organizational culture that reduces human error (Helmreich & Merritt, 2001). Human attitudes and behaviors can be shaped by a systematically designed safety culture to reduce safety errors and violations in high-risk organizations (Shappell & Wiegmann, 2000).

This study was conducted in the TNP Aviation Department and its subunits, where little, if any, literature appears on this topic. Few studies have been performed on employees' behavior in the workplace and organizational influence, particularly in an aviation context (Baron, 2008). Although no empirical study has been conducted in a police aviation context, the organizational factors of safety behavior have been investigated in other industries, including construction, manufacturing, medicine, and nuclear plants. The members of the TNP Police Aviation Department are qualified personnel performing high-risk duties during their work hours (Alpert, 1998). They have a semi-autonomous working environment guided by safety procedures and

regulations (Helmreich & Merritt, 2001). However, they also have discretion in obeying procedures and regulations when conducting their missions. The nature of their duties presents an obstacle to the direct observation of aviation employees in determining whether they comply with safety rules and regulations during their shifts. Their attitudes and behaviors pertaining to safety can be observed via survey questions. The variance in TNP Aviation Department members' safety behavior can be explained by the variance in the perceived organizational safety culture. Informal structures emerging in the organization also vary among sub-groups because members having different characteristics perform different tasks based on different SOPs, workflow charts, and regulations. Examining the differences among the subcultures of the TNP Aviation Department has the potential to contribute the safety culture literature in terms of subculture differences.

Conducting confirmatory factor analysis with structural equation modeling (SEM) was the methodological strength of this study. The structural equation modeling technique has been widely and effectively used in behavioral science because it can develop and validate the measurement models of latent constructs (Schumacker & Lomax, 2004; Byrne, 2010). This study focused on the relation between organizational safety culture and individuals' safety behavior based on the proposition that human attitudes and behaviors can be shaped by organizational safety culture to reduce human errors and safety violations in high-risk organizations. The study variables were latent constructs having multiple indicators. Safety climate was conceptualized via four components including individual attitude, group norms, management attitude, and workplace pressures. Safety behavior was conceptualized as multidimensional construct having two components: violation and error behavior. These components were first validated separately.

Then the validated components of organizational safety climate and individual safety behavior were integrated as multi-factor measurement models and validated by confirmatory factor analysis (Wan, 2002). This study, therefore, has the potential to introduce valid and reliable measurement concepts for organizational- and individual-level safety constructs by using confirmatory factor analysis.

The complex relationship between the high-risk environment and the individual was studied by many researchers. In the following section, accidents analysis and human factors models were discussed to comprehend the literature. Organization culture, climate, safety culture and climate, and conceptualization of these constructs were further evaluated. Several studies on safety culture and behavior were presented based on their theoretical and methodological backgrounds. The theory of planned behavior guided the study model to make clear the mechanisms underlying the relations between culture and behavior.

CHAPTER 2 LITERATURE REVIEW

Several models explain human factors in aviation accidents, including individual failures and contributing latent factors such as preconditions and organizational influence. Mainstream human error models are presented at the beginning of this section; then organizational culture, safety culture, and climate concepts are discussed in detail. The formation of individuals' behavior in the workplace is discussed based on three organizational climate approaches. The conceptualization of safety culture is assessed based on previous studies and their results. Lastly, the theory of planned behavior (TPB) is presented to guide the theoretical model of this study.

2.1 Human Error Models

Human error is the largest contributing factor in all aviation accidents and incidents (Li et al., 2001; Wiegmann & Shappell, 2003; Duffey & Saull, 2004; Dekker, 2005). High-risk industries, such as construction, transportation, nuclear power, and oil production, as well as aviation, are more vulnerable to human error (Wiegmann & Shappell, 2003; Duffey & Saull, 2004). A significant amount of work has been published about understanding the occurrence of human error within complex systems. While organizational design, teamwork, and communication are widespread topics, organizational culture, safety behavior, and safety performance have been relatively less studied by researchers (Cooper & Phillips, 2004).

Throughout the early years of aviation, most research focused on the aircraft itself and the individuals who were flying the aircraft (Wiegmann & Shappell, 2003). In most cases,

individuals rather than organizations were charged in aviation accidents for several reasons. First, it was easier to assign legal responsibility to individuals. Second, it was easier to link an individual’s error with the accident because the relation was easy to observe. Third, there are a limited number of studies demonstrating organizational failures related to aviation accidents because of the unobservable nature of the relation between organizational variables and accidents. Lastly, blaming individuals rather than corporations was financially advantageous to organizations (Maurino et al., 1995). However, in recent years, researchers have realized the presence of organizational influences on the complex nature of human-related accidents (Helmreich & Merritt, 2001). Researchers in this area have developed accident causation and classification models demonstrating how organizational variables influence individual behavior, which in turn can lead to mishaps (Wiegmann & Shappell, 2003).

Bird’s (1974) domino theory is known as the earliest and the most famous model of the organizational influences on human-related mishaps. The theory proposes that any mishap is a consequence of a sequence of events, each influencing the following one in a logical order. Immediate causes or the most recent action of the individual had been supposed to be the only important factor in accidents before the development of the domino theory. However, Bird claims that the last action of an individual should be seen as the last falling domino in a series of falling dominos; for example, errors occurring through management-interaction and supervisory failures that preceded the final action and might account for the individual’s failure (Bird, 1974).

Bird’s domino theory has been expanded by renaming the metaphorical dominos as *management structure*, *operational*, and *tactical errors* (Wiegmann & Shappell, 2003). While

tactical errors relate to an individual’s behavior and working conditions, operational errors are related to organizational management behavior. The domino theory and additional constructs examine the reason for the accident, as well as identifying the organization’s situation in regard to safety knowledge, regulations, and standards relating to safety operations. The theory emphasizes the likelihood of confusion among individuals’ perceptions of the organization’s goal, the roles and responsibilities of other participants, and accountability assignment (Wiegmann & Shappell, 2001; 2003).

Another approach has been proposed by Degani and Wiener (1994) to identify the relation between management philosophy, organizational policies, operational procedures, and individuals’ practices during flight-related work. Authors suggest that these factors constantly interact during operations. However, ambiguities in these factors or emerging conflicts between factors can jeopardize safety (Degani & Wiener, 1994). Wiegmann and Shappell (2003) offered an example clarifying Degani and Wiener’s (1994) model. Commercial airlines have a philosophy based on improving on-time flight percentage and promoting safety. Airline companies develop extensive procedures and plans to ensure safe and on-time flight schedules. Each phase of the pre- and post-flight routines and their procedures is prepared in detail, and both flight crew and support staff are expected to comply with these procedures. However, many commercial airlines are motivated by profit rather than operational safety. Moreover, safety always takes more effort and requires time. The emerging conflict between an airline’s philosophy, policy, procedures, and practices may pressure individuals into unsafe practices, leading to mishaps (Wiegmann & Shappell, 2003).

The organizational factors in aviation accidents may remain unnoticed by organizational members for a long time (Turner, 1983). Inactive and unobservable factors may lead to unforeseen disasters by triggering any event leading to the accident. Turner’s model assumed that it was necessary to separate the causal factors of the accident from the series of events leading to the accident. On the other hand, Perrow (1999) highlighted the essential role of organizational management in complex organizations. The complexity of organizations arises from the cutting-edge technology of their instruments, as well as the development of their management systems. Complex organizations are more vulnerable to accidents than less complex organizations. Hence, Perrow (1999) saw aviation accidents as “normal accidents” because of the industry’s complexity. The failures inherent in complex aviation systems can be managed by strong management, which is more important in complex organizations than before (Perrow, 1999).

One of the best-known human error models is Reason’s (1990) Swiss cheese model of error causation. Reason focused on *active* and *latent* types of error. While active errors are almost directly recognizable, latent errors are inactive up to the time they suddenly trigger the accident. The importance of latent errors in human-related accidents is emphasized to explain the relationship between three hierarchical layers—preconditions for unsafe acts, unsafe supervision, and organizational influences, respectively. Any failure in the interactions of these factors causes “holes” in the system (Reason, 1990; 2000). With the contribution of these latent factors, an accident happens as an end consequence of a number of these failures, the last of which is an individual’s unsafe action (Helmreich & Merritt, 2001; Reason, 1990).

Wiegmann and Shappell (2001; 2003) proposed a further developed version of Reason's model, identifying subcategories for each of four layers: unsafe behavior of the individual, preconditions for unsafe acts, unsafe supervision, and organizational influences. The human factor analysis and classification system has been generally accepted as a reliable model to explain individuals' unsafe behavior by the aviation industry, as well as by the U.S. Department of Defense, since the model conceptualizes and applies the Swiss cheese model in the real world setting (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Shappell et al., 2007). *Organizational influences* refer to management's contributions of fallible decisions that can directly influence supervisory practices as well as individual behavior. The authors subcategorize organizational influences into resource management, organizational process, and organizational climate. *Organizational climate* refers to a series of organizational characteristics, including the structure of the organization, designed policies, and organizational culture (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; 2003; Shappell et al., 2007). Organizational climate and culture as latent factors have been detailed and developed parallel to human error models.

The climate and culture of organizations have been investigated as root factors affecting individual's safety behavior in the workplace. One of the prominent organizational climate scholars, Zohar (1980), defined *organizational climate* as the shared perceptions of individuals about the organization where they work. Organizations develop several distinct climates including motivational, creative, and safety, all of which affect individual behavior in the workplace. Zohar primarily focused on the safety climate. Accordingly, *safety climate* refers to individuals' shared perceptions about organizational and managerial safety commitment, the

measures taken to promote safety, and fellow employees' devotion to safety precautions, standards, and procedures (Zohar, 1980).

Organizational culture, a relevant concept with climate, is considered a determining factor of individual's safety behavior. The culture of an organization significantly influences individuals' value systems, attitudes, and behaviors (Lundberg, 1985). Schein (2004) defined organizational culture as a system of individuals' shared beliefs, attitudes, values, and norms that governs the behaviors of individuals and groups. Culture is transferred to successive generations through the socialization of newcomers into the group. Because of the social learning process, several types of culture develop in which "organizations generate their collections of meaning by drawing on and adopting the mores, archetypes, metamyths, and values which form the fabric of the host society" (Moore, 1985, p. 227). Organizational culture and climate are discussed in detail in the following section, as both are closely related to the context of this study.

2.2 Organizational Culture

Culture studies attempts to interpret and understand how culture affects individual-, group- and societal-level behaviors (Ostroff, Kinicki, & Tamkins, 2003). While a significant amount of research was published during the 1940s and 1950s, the Hawthorne studies can be seen as the first systematic qualitative analysis examining individual and group behavior (Landy & Conte, 2010). During the 1960s, quantitative analyses in organizational studies sharply increased. However, the culture and climate concepts were regarded as nearly the same; thus

several researchers used the notion of culture instead of climate in early organizational studies (Hofstede, Neuijen, Ohayv, & Sanders, 1990).

Conceptualization of organizational culture abounded during the 1970s. However, theoretical frameworks of organizational culture have often been criticized for being purely theoretical and lacking a satisfying empirical methodology (Ostroff et al., 2003). Differences in study object priorities also occurred among researchers. The importance of leadership behaviors, values, and vision in shaping organizational culture, artifacts and values has been strongly emphasized by some theorists (Schein, 2004). On the other hand, the influence of the symbolic experiences organizations continuously live has been highly regarded, with a concurrent minimizing of the role of leaders, by other theorists. Likewise, the environment and large-scale constructs, including market characteristics, ownership and control, resource availability, nature of history, and social-cultural dimensions, have been considered factors shaping organizational culture by some theorists. Other theorists have examined organizational culture from a narrower perspective, naming business and industry environments as the key roots of the phenomena (Ostroff et al., 2003).

Several perspectives and theoretical frameworks have generated a variety of meanings and models for the organizational culture construct. Their content has varied depending on the research domain and interests of the theorists (Denison, 1996). However, these approaches also have some commonalities. Accordingly, organizational culture includes multiple layers; is influenced by historical and spatial boundaries; and names the concept of “shared” as the most important interpretative point (Ostroff et al., 2003; Schein, 2004). Schein’s (2004) definition

embraced several qualities and perspectives of culture. Accordingly, culture is "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein, 2004, p.17).

Culture has three hierarchical layers: artifacts, values, and basic assumptions (Schein, 2004). Artifacts consist of the tangible, visible, and audible results of action or reflections of the values and assumptions of an organization. Artifacts are mostly embodied in observable rituals, ceremonies, technology used, physical environment, uniforms, and furniture (Schein, 2004). On the other hand, values are ordered by comparative importance and based on beliefs or concepts (Ostroff et al., 2003). Values guide individuals' selections among several options; as well, they shape the assessment of beliefs and events, which play a critical role in organizational life (Hinings, Thibault, Slack, & Kikulis, 1996).

According to Schein (2004), basic assumptions are the core of organizational culture, but these are difficult to observe directly. Fundamentally, assumptions are generated by values. Values are beliefs about reality and human nature over time. They are extremely difficult to change and rarely an issue of debate. Basic assumptions are of great importance, because they guide organizational members to play certain roles and to rationalize their attitudes depending on the circumstances. The culture of any organization can be observed by the climate of the whole organization with its codes, values, norms, rules, expected and valued behaviors (Westrum,

1996). This study measured organizational culture via its climate facet. Hence, organizational climate is discussed in detail in the following section.

2.3 Organizational Climate

Organizational climate studies have received considerable attention from organizational sociologists and applied psychologists since the 1980s. Researchers have primarily been interested in tracing the organizational dynamics influencing individuals' and groups' perceptions of shared understandings and opportunities to translate these perceptions into particular outcomes (Schneider & Salvaggio, 2002). A major consideration stemming from the translation of perceptions to outcomes has revolved around whether the concept should be based on objective organizational properties or on individuals' perceptions. The level of conceptualization and measurement characteristics of the construct has been another study problem pertaining to organizational climate (Kozlowski & Doherty, 1989; Schneider & Salvaggio, 2002). At present, the term has been further refined by sorting through existing definitions, such as the definition of organizational climate, which is widely referred to as transpersonal perceptions of organizational policies, procedures, and practices (Schneider & Salvaggio, 2002).

Relying on perceptions and beliefs has presented methodological advantages, in which climate was conceptualized as sets of perceptions through organizational features, events, and processes (Kozlowski & Doherty, 1989). In the course of time, the perceptual approach has dominated other climate definitions and induced shared perception approaches and cognitive

schemas (Anderson & West, 1998). Individuals may have a group agreement about organizational climate; however, this level of agreement does not necessarily indicate a perfect understanding. The intensity of agreement refers to the strength of the climate, which is defined as a distinct property or a level of quality for the organization (Brandt, 2000). Relations between organizational climate and outcomes have been empirically demonstrated and show that strength of climate contributes consistently to individual behavior. A strong climate occurs when members perceive events the same way and their expectations are clear (Schneider & Salvaggio, 2002).

Conceptualization of climate has been tested with molar models to explain the relation between the perceptions of individuals about organization and their consequent behavior (Kozlowski & Doherty, 1989). However, individuals arrive at different general assumptions and conclusions about their environment; this differentiation results in behavioral change (Ostroff, 1993). In other words, it is not necessary for individuals to have a common agreement on organizational climate; rather, individuals may perceive their organization's climate differently. Hence, their perceptions may affect their behaviors differently.

Three approaches have been reported on the formation of organizational climate in workplaces (Schneider & Reichers, 1983). The structuralist approach emphasizes the organizational structure, including size, centrality of authority, number of hierarchy levels, technology, and the degree of regulations and policies constraining individual behavior, which influences the attitudes, values, and perceptions of individuals. This model acknowledges individual differences and the possibility of variances in perceptions; however, the major

effective role is assigned to the organization's structural features (Schneider & Reichers, 1983). Since individuals in an organization live in the same environment and experience similar situations formed by the organizational structure, they are affected by and respond to these situations in similar ways within the organizational climate. However, this model has been criticized for failing to offer empirical support and considering possible climate differences among workgroups performing different tasks in the same organization (Schneider & Reichers, 1983). It can be concluded that structural characteristics are important in the formation of organizational climate; however, this model is not adequate to explain the existence of climate differences among subgroups despite being influenced by the same structural factors.

The attraction-selection-attrition (ASA) approach emphasizes the role of the founders or significant members of an organization, who first determine the ideal form of its structure, value systems, and processes (Schneider & Reichers, 1983). The emergence of an organizational climate is explained by a sequence of concepts. First, individuals are attracted to organizations matching their personal attributes. Individuals perceive that they can satisfy their needs and implement their self-concepts in the specified organization. On the organization side, however, filtering or selection processes are conducted to recruit and select among candidates based on the harmony that exists between the candidate's personal attributes and the expected job performance, values, and goals of the organization. Disharmony between an individual and an organization gives rise either to dismissal or resignation of the work agreement. The attrition phase consists of the process of improving homogeneity among members, who are expected to have similar perceptions and interpretations about the organization (Schneider & Reichers, 1983).

Both similarities and differences exist between the two approaches. While the structuralist approach focuses on the objective features of the organization, the ASA approach gives credence to individual perceptions on the supposition that perceptions are similar among homogenous members. Both approaches ignore the possible differences among individuals' and subgroups' perceptions of the climate. The ASA approach considers similar and homogenous subcultures because individuals are filtered according to organizational requirements. The structuralist approach, however, ignores climate differences among subgroups because they live in the same environment and experience similar situations. However, Zohar and Luria (2005) presented empirical findings on the different climate perceptions among hierarchical levels: A supervisor and a line worker have different climate perceptions despite working in the same environment (Zohar & Luria, 2005).

A third model, the symbolic interaction approach, states that perceptions consist of individuals' interpretations of the organizational context, resulting in interactions of individual and contextual factors. Interactions generate a logical process about organizational environment; individuals give interpretations of events that depend neither on objective characteristics nor on perceptions alone. As a result, events are interpreted by individuals through the interaction of people within the environment. This approach focuses on the interaction process that occurs especially during the newcomer's socialization phase. Group membership is another important function resulting in different types of climate across subgroups in the organization (Schneider & Reichers, 1983). Powell and Butterfield (1978) point to the role of departments, hierarchical levels, workgroups, and significant reference groups in influencing worker perceptions and interpretations of organizational events. The interaction of individuals establishes relationships

between people, which guides individuals through defining, responding to, and interpreting organizational climate (Powell & Butterfield, 1978).

The symbolic interaction approach has several advantages over the previous perspectives because it can explain the theoretical basis of group differences. As well, the symbolic interaction approach uses specific research techniques such as observation, interviews, and surveys in order to define the social units in which individuals frequently interact on a variety of issues during working hours (Schneider & Reichers, 1983). Third, the symbolic interaction approach perceives organizational climates as dynamic rather than static, in contrast to previous approaches. This refers to the possibility of altering, modifying, and designing an organizational climate to improve desired outcomes through a set of interventions. Symbolic interaction can guide an organization's management to design and manipulate climatic dynamics when there is a need to reorganize the organizational variables (Schneider & Reichers, 1983). The symbolic interaction approach was therefore chosen as the main perspective for and guide in establishing the theoretical model of this study.

2.4 Safety Culture and Climate

The safety culture of an organization shapes individuals' beliefs, values, and behaviors because it creates advantages or disadvantages based on the message it gives to group members (Helmreich & Merritt, 2001). Several definitions of the concept exist in the literature. However, Wiegmann (2002) aggregates the term's common features. The term refers to the shared values among an organization's members, related to formal safety issues and the organization's

willingness to learn from errors, ability to integrate contributions from members at every level of the hierarchy, power to influence individuals' behavior, and status as relatively stable, enduring, and resistant to change (Wiegmann et al., 2002).

While organizational climate refers to individuals' perceptions of the practices, procedures, regulations, and structure of an organization (Schneider & Salvaggio, 2002), the notion of safety climate pertains to the perceptions of individuals regarding an organization's safety culture at a particular time (Wiegmann et al., 2002). In other words, safety climate is an immediate picture of safety culture, which has an inconstant nature and is subject to change based on situational and environmental factors (Baron, 2008). While the safety culture concept is difficult to measure, various instruments have been developed to measure safety climate (Hall, 2006). Organizational safety climate is the measurable facet of organizational safety culture; in other words, climate is the tangible and observable part of culture. It can be concluded that safety culture can be observed and measured by using a safety climate measurement instrument (Hall, 2006; Baron, 2008; Fogarty & Shaw, 2009).

2.5 Conceptualization of Safety Culture

Concern has been growing in recent years over the safety culture in high-risk industries, including nuclear power plants, construction, and medicine. However, few researchers have studied the safety culture of the aviation industry or organizational failures in relation to aviation accidents (Helmreich & Merritt, 2001; Wiegmann et al., 2002). Accident causation theories have developed through four stages, all of which sought to pinpoint the root causes of aviation

accidents (Wiegmann & Shappell, 2001). The first stage, the technical period, referred to the point at which mechanical systems were still being designed, developed, and tested. Most aviation accidents were attributed to mechanical malfunctions, design failures, and equipment deficiencies (Wiegmann & Shappell, 2001). As aviation technology became more reliable, failures were attributed to the humans operating this technology. Responsibility and blame for accidents were assigned to the individuals performing the last unsafe action leading the accident (Wiegmann & Shappell, 2001; Wiegmann et al., 2002). The socio-technical phase considered the interaction of individuals and mechanical systems to be the causes of aviation accidents. The organizational culture period emerged as the fourth stage; it emphasizes the importance of environment and other factors in the organizational context (Wiegmann & Shappell, 2001; Wiegmann et al., 2002).

The organizational culture approach offers several advantages compared with the three previous approaches. First, the interaction between human and technological tools does not occur in area vacuum; rather, it occurs among a coordinated team and within a particular culture (Wiegmann & Shappell, 2001; Wiegmann et al., 2002). Second, considering unsafe behaviors in collective terms offers many advantages over blaming the individual who performed the most recent action (Maurino et al., 1995; Wiegmann & Shappell, 2003). Third, a reliable organizational culture can encourage the development of better technological tools and discipline in the operators using them. Lastly, while the first three approaches explore only one facet of the whole, the organizational culture approach recognizes each part of the organization, since the culture relates to each actor in the organization and covers interactions and relations among these

actors. Hence, the conceptualization of safety culture is notable for its ability to reflect an organization's content and measure its constructs in the aviation context.

The conceptualization of organizational safety culture has been defined according to the area of research and academic discipline (Helmreich & Merritt, 2001). Hence, several different organizational safety culture concepts have emerged in different areas. We can, however, group these approaches into two broad categories (Wiegmann et al., 2002). The socio-anthropological perspective examines the original formation of symbols, norms, meanings, heroes, and rituals revealed in the shared values and myths of the organization in order to understand the organizational culture. The culture of an organization is revealed in members' attitudes and behaviors. Hence, the root structure of a culture is hard for outsiders to observe; rather, it can be most easily sensed by members. The socio-anthropological perspective argues that it is necessary to use ethnographic approaches to study a culture, including extensive and intensive observations, and interviews with members (Schein, 1991, as cited in Wiegmann et al., 2002). The culture of an organization is assumed to be an emergent property produced by the history and notable members of the organization. In this view, organizational culture is more than the sum of its parts; breaking a culture into subcomponents in order to study it does not necessarily yield understanding of the phenomena involved. Lastly, the socio-anthropological perspective considers organizational culture an "evolved construct" that is historically rooted, collectively held, and adequately resistant to change and direct manipulation (Wiegmann et al., 2002).

Similarly to the socio-anthropological perspective, the organizational psychology perspective identifies organizational culture as the shared values and beliefs of members, myths,

stories, legends, rituals, and exceptional language. However, the functional importance of organizational culture and the manipulation potential to increase productivity are emphasized rather than content and structure (Wiegmann et al., 2002). Members derive a sense of identity from the organization and commit themselves to something more important than the self, which shapes their behavior in the workplace. The organizational psychology perspective draws a relation between strategic management interest and organizational behavior (Wiegmann et al., 2002).

For researchers, the organizational psychology perspective is more useful than the socio-anthropological perspective because it provides a means of manipulating and modifying organizational culture, as well as empirically demonstrating the relation between culture and desired outputs. Culture has separable subcomponents that are empirically traceable and quantitatively observable by traditional analytic methods. Therefore, the majority of organizational culture studies have used the organizational psychology perspective while observing the culture and its effects on organizational outputs, such as service quality, employee motivation, job satisfaction, occupational safety, and productivity (Wiegmann et al., 2002). Indeed, the aviation safety literature contains various studies guided by the organizational psychology perspective. This study was also guided by the organizational psychology perspective to conceptualize the organizational safety culture construct, which was measured as a multidimensional measurement model with its subcomponents. Previous studies on aviation safety culture were examined to trace the dimensions of organizational culture, as well as to construct more reliable measurement models by which to observe the safety culture of the TNP Aviation Department.

2.6 Previous Studies on Safety Culture

Many authors prefer to observe safety culture with safety climate measurement surveys. Several different models have been established to measure safety culture construct including multi-dimensional, higher factor, and theory based models. A couple of example for each was presented in the following topics.

2.6.1 Multi-dimensional Models

Although Zohar's (1980) study did not focus on aviation, but on the metal, food processing, chemical, and textile industries, it is worth mentioning first because it was the first study on safety culture in high-risk organizations. Zohar developed a safety climate measurement survey for industrial organizations in Israel, including 20 Israeli factories, and had a sample size of 400. The questionnaire contained 40 items and eight factors and aimed to define organizational characteristics in order to separate organizations in terms of low and high accident rates. He conceptualized safety climate as comprising eight dimensions, including the importance of safety training programs, management attitudes toward safety, the effects of safe conduct on promotion, level of risk in the workplace, the effects of the required work pace on safety, the status of safety officers, the effects of safe conduct on social status, and the status of the safety committee. Each scale was generated by between two and nine questions.

Zohar found that two climate dimensions were most influential in observing safety climate levels: the perceived relevance of safety to job behavior and the perceived management attitude toward safety. Management's attitude toward safety was regarded as the major factor

affecting safety culture in organizations. It was concluded that safety should be regarded as an integral part of an organization's production system and general management responsibilities. Zohar compared organizations from different industries, combining different technologies and risk levels in the same model. However, he argued that the measure he used is independent from these factors (Zohar, 1980).

A follow-up study was conducted by Brown and Holmes (1986) in North America to assess the validity of Zohar's safety climate questionnaire. Confirmatory factor analysis with LISREL was used to test the covariance structures of Zohar's proposed model with data acquired from ten manufacturing and produce companies in the United States, with 425 items in the sample. Zohar's proposed model was not supported by Brown and Holmes' data. Rather, the authors investigated a three-factor model as opposed to Zohar's eight-factor model. They conducted explanatory factor analysis to refine the model and to observe the differences between employees who had accidents and those who did not. There was no difference across the groups in terms of safety climate structure, and the three-factor model fit the data better. Accordingly, the safety climate model had three dimensions, including employee perception of how concerned management is with their well-being, employee perception of how active management is in responding to this concern, and employee physical risk perception (Brown & Holmes, 1986).

2.6.2 Higher Order Factor Models

Higher-order factor measurement models have been conceptualized to measure safety climate construct by many authors (Westrum, 1996; Griffin & Neal, 2000; Reason, 2000; Parker,

Lawrie, & Hudson, 2006). Several first-order factors, including individuals' perceptions about safety-related policies, regulations, management attitudes, procedures, and rewards, were proposed as the safety climate construct's first-order factors. Griffin and Neal (2000) used confirmatory factor analysis and structural equation modeling to test the validation of higher-factor models with data acquired from 1,264 employees working for the mining and manufacturing industry in Australia. An 81-item questionnaire was used to observe employees' attitudes, behaviors, and safety procedures. First a null model, then 1-, 3-, 4-, and 7-factor models were tested respectively. Finally, a higher-order factor analysis was tested, in which safety climate was assumed to be first-order, and management values, safety communication, safety practices, safety training, and safety equipment were assumed as second-order. The higher-factor model had acceptable goodness-of-fit parameters with the data even though the fit of the last model had lower scores than previous models. Safety climate, as the second-order factor, illustrated the individual's perception regarding the extent to which safety is valued in the organization. The results supported the relation between the safety climate and the safety performance of the organization (Griffin & Neal, 2000).

Westrum (1996) developed a four-factor model to observe safety culture. In this model, information, stress, pressure on safety, and attitudes toward rogue practitioners were considered safety culture dimensions. While *information* refers to an organization's response to information about safety, *pressure on safety* indicates the trade-off power of safety when it is compared to time, money, and work risk in such activities as the high-speed pursuit of criminals and search and rescue (Westrum, 1996). Similar dimensions were proposed by Reason (2000), who asserted that information, reporting, trust, flexibility, and integrity are principal characteristics of an

effective safety culture. Organizations having effective safety cultures have information systems that collect data from incidents and near misses for analysis. Individuals are encouraged to voluntarily report their mistakes and errors without fear of reprisal. Trust is a necessity between individuals and managerial staff. An effective safety culture requires a flexible task environment that has the ability to reconfigure itself. Lastly, management should be honest in order to reach the right conclusion and implement reform measures as required (Reason, 2000).

Parker, Lawrie, and Hudson (2006) built upon Reason's (2000) model to determine the characteristics of an organization having a reliable safety culture. The authors added one additional feature, which they termed a "no-blame" culture. The fundamental premise behind the no-blame culture is that members of the organization may agree on some actions as totally unacceptable. However, the basis for these actions requires a process that has objectively assessed the relevant issues without blaming individuals. The authors posited that if agreement occurs but blame is assessed, members of the organization are more likely to hide their mistakes and errors (Parker et al., 2006).

The basic requirements for a safety culture were aggregated by Helmreich (1999) with a causal mechanism. Trust, a non-punitive attitude toward individuals' errors, commitment to reducing error-inducing factors, data gathering about types of errors and probable threats, error avoidance and threat recognition training programs, and evaluation of training programs were considered the requirements for a safety culture. Trust and non-punitive policies toward individuals' errors makes members of an organization more likely to report their mistakes and take a proactive attitude toward safety. In addition, a training program about error avoidance and

threat recognition increases the safety level of flight operations. Training program evaluations help to ensure that the safety performance objectives of the organization are met (Helmreich, 1999). For example, information gathered about the types of errors and probable threats indicates the holes in the respective defenses of organizational and managerial layers and presents action items for management to consider. The response rate of these observed errors can indicate that management is moving toward a more proactive approach to safety (Helmreich, 1999).

A safety climate scale was developed by Seo, Torabi, Blair, and Ellis (2004) by including several constructs used in the literature. A cross-sectional survey was conducted on 722 grain industry workers in the U.S. An item pool was generated by expert reviews, scientific reduction processes, and a pilot test. Accordingly, safety climate had five dimensions, including management commitment, supervisor support, coworker support, employee participation, and competence level. The proposed model was validated by both explanatory and confirmatory factor analysis. This study provided a consistent factor structure that most previous studies had failed to find. All factors were predominantly accounted for by the proposed constructs except for two items, which the unexpected relationship were reasonably justified. All of the indicators had statistically significant and acceptable factor loadings in the confirmatory factor analysis, and all of the goodness-of-fit indices showed a good fit with the data. The five-factor model was cross-validated as having an appropriate level of reliability and validity, and was arguably the first study to have a consistent factor structure for safety climate. However, the study was conducted on the grain industry and may not generalize to other high-risk industries. Second, the study lacked a theoretical framework to guide the causal mechanism of the formation of safety culture in the workplace (Seo, Torabi, Blair, & Ellis, 2004).

2.6.3 Theory Based Models

The previous safety climate conceptualizations demonstrate that the majority of the studies were explanatory in nature and aimed to develop safety climate surveys, as well as to identify the relations among subscales. However, many of the studies have not been guided by substantial theoretical frameworks to explain the formation of safety culture and its effects on individual behavior. Fogarty and Shaw (2009) designed their study to clarify the formation of safety culture and the mechanisms underlying the relation between the safety climate of an organization and the safety behavior of the organization's members. A sample of 308 aircraft maintenance workers was surveyed to observe employees' perceptions on management attitudes toward safety, personal attitudes toward safety, group norms, workplace pressures, intentions regarding safety behavior, and safety violations. Path analysis was conducted by using AMOS software to assess the relations among latent variables constructed by confirmatory factor analysis. The relations of the variables and pathway construction were guided by Ajzen's (1991; 2005) theory of planned behavior (TPB), which is discussed in the next section. The results indicated excellent goodness-of-fit statistics and r-squared values for all hypotheses proposed (Fogarty & Shaw, 2009). The model accounted for 50% of the variance in individuals' safety violations and 47% of the variance in intention to violate. The safety climate model of this study was developed based on Fogarty and Shaw's (2009) model using TPB. This study conceptualized safety behavior by using Wiegmann and Shappell's (2001; 2003; 2005) human factor analysis and classification system. Accordingly, individuals' unsafe acts could be classified into two dimensions: violation and error behaviors. While *violation* refers to willful

disregard for formal safety procedures, *error* refers to individuals' accidental failure to achieve intended outcomes (Wiegmann & Shappell, 2001; 2003; Wiegmann et al., 2005).

2.7 The Theory of Planned Behavior

A majority of the previous studies on the organizational factors of safety behavior lacked theoretical guidance to explain the psychological aspects of employee safety behavior (Zohar, 2000; Glendon & Litherland, 2001). Several safety climate surveys have been developed since Zohar's (1980) study. However, few studies have been designed on a behavior theory basis (Hall, 2006; Baron, 2008; Fogarty & Shaw, 2009). Organizational culture is an unobservable construct with many dimensions, and it is realistic to assume that many employees probably do not realize its existence or how culture influences their behavior. This study aims to identify the influence of organizational safety culture on the individual safety behavior variance of the TNP Aviation Department. A theoretical orientation helps lay the groundwork for the study (Hall, 2006; Baron, 2008; Fogarty & Shaw, 2009).

The theoretical framework of the study was formed by Ajzen's (1991; 2005) theory of planned behavior (TPB), which explains the psychological aspects of employee behavior (Baron, 2008). The principal assumption of the TPB has to do with the intentions behind any human action. Intentions to perform any kind of behavior are guided by different considerations: attitude toward behavior, subjective norm, and perceived behavioral control.

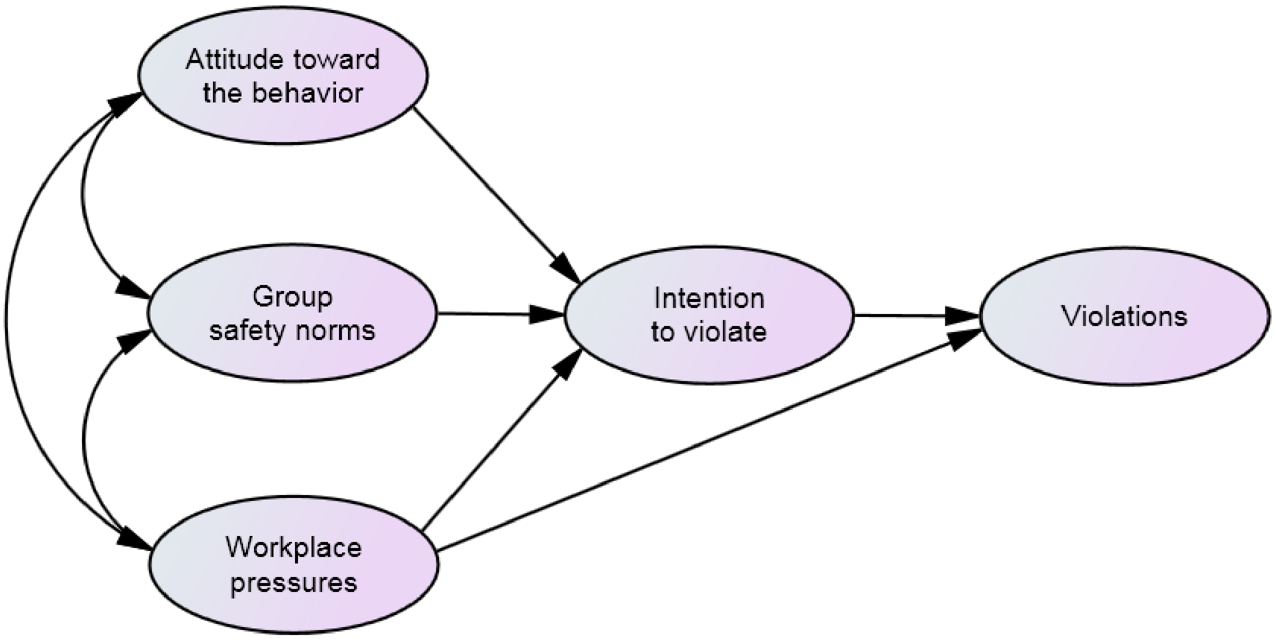

Figure 1. The Theory of Planned Behavior (Ajzen, 1991)

Figure 1 illustrates the principal components of Ajzen's theory of planned behavior. Individuals' intentions regarding any kind of behavior can be predicted with a high degree of accuracy by their attitudes toward behavior, subjective norms, and perceived behavioral control constructs. Second, the predicted intentions, together with perceived behavioral control, can explain variances in actual behavior (Ajzen, 1991; 2005).

The assumption that individuals have attitudes toward certain behaviors is reasonable. However, an individual's actual behavior is an output of the individual's attitudes, subjective norms, and work pressures. Subjective norms refer to the perceived beliefs and behaviors of others who have a strong influence on the individual's views (Fogarty & Shaw, 2009). These might be closely associated friends or colleagues of the individual. Perceived behavioral control is the third predictor of intention, and a direct predictor of actual behavior. Perceived behavioral

control refers to outside factors that prevent an individual from performing a certain behavior even if the individual has a strong inclination to perform it. Examples of external influences can include malfunctioning or problematic instrument features, regulations, lack of time or personnel, pressures exerted by the management, customers, peers, and self-induced pressure—in other words, factors beyond an individual's control (Hall, 2006).

According to Fogarty and Shaw (2009), Ajzen introduced the intention variable to strengthen the relation between attitudes and behavior, because attitudes sometimes fail to become behavior due to many other factors preventing individuals from converting their attitudes into behaviors. In other words, an individual's own attitude toward behavior, subjective norms, and perceived behavioral control can be used to predict intentions regarding any safety issue. Intention can in this way be used to predict actual safety behavior (Hall, 2006; Fogarty & Shaw, 2009).

The theory can be applied to the safety behavior concept with an example from the police aviation context. The example demonstrates how an employee's safety behavior might occur through the guidance of TPB. A flight helmet is a vital safety tool for helicopter pilots because it protects them in an accident. It is also a safety rule to put one on during flights. However, some pilots do not want to use it. This behavior can be regarded as an unsafe behavior. According to TPB, the pilot has developed a negative attitude toward the flight helmet. Second, the pilot is influenced by fellow pilots' attitudes toward flight helmets. TPB identifies this consideration as a "group norm" (Baron, 2008). Third, the pilot perceives the flight helmet as a troublesome object. The helmet might save the pilot's head in case of an accident, but it can also make the pilot's

head hot and obstruct the pilot's movement during flight. These three latent constructs lead the pilot to have a specific intention about using the flight helmet, which along with workplace pressures can predict his behavior regarding helmet usage (Ajzen, 1991; 2005). Similar examples include maintenance personnel's attitudes toward safety goggles and office staff's attitude toward traffic cones.

The conceptual model of the study was developed by Fogarty and Shaw (2009) based on Ajzen's TPB. Although TPB does not include management's attitude toward safety, employees' perceptions of managers' attitudes toward safety have been frequently proposed as the most important predictor of an organization's safety climate (Zohar, 1980; Hall, 2006; Fogarty & Shaw, 2009). The difference between Ajzen's TPB and Fogarty and Shaw's conceptual model can be seen in the safety climate conceptualization. While Ajzen proposed correlations between safety climate dimensions, Fogarty and Shaw preferred the idea of directional pathways among components. The final model put forth by Fogarty and Shaw was quite different from their conceptual model in that the paths between perceived behavioral control and violation, as well as management attitude and intention, were removed. Moreover, new paths between own attitude and violation, and group norms and violation, were inserted in the final model.

This study established a conceptual model using Ajzen's theory of planned behavior (TPB) and included management attitude in the safety climate construct. Safety climate was conceptualized with four components, including own attitude, group norms, management attitude, and workplace pressures. Correlation arrows were placed between components, as

proposed by Ajzen. Safety behavior was conceptualized with two components, including violation and error behavior.

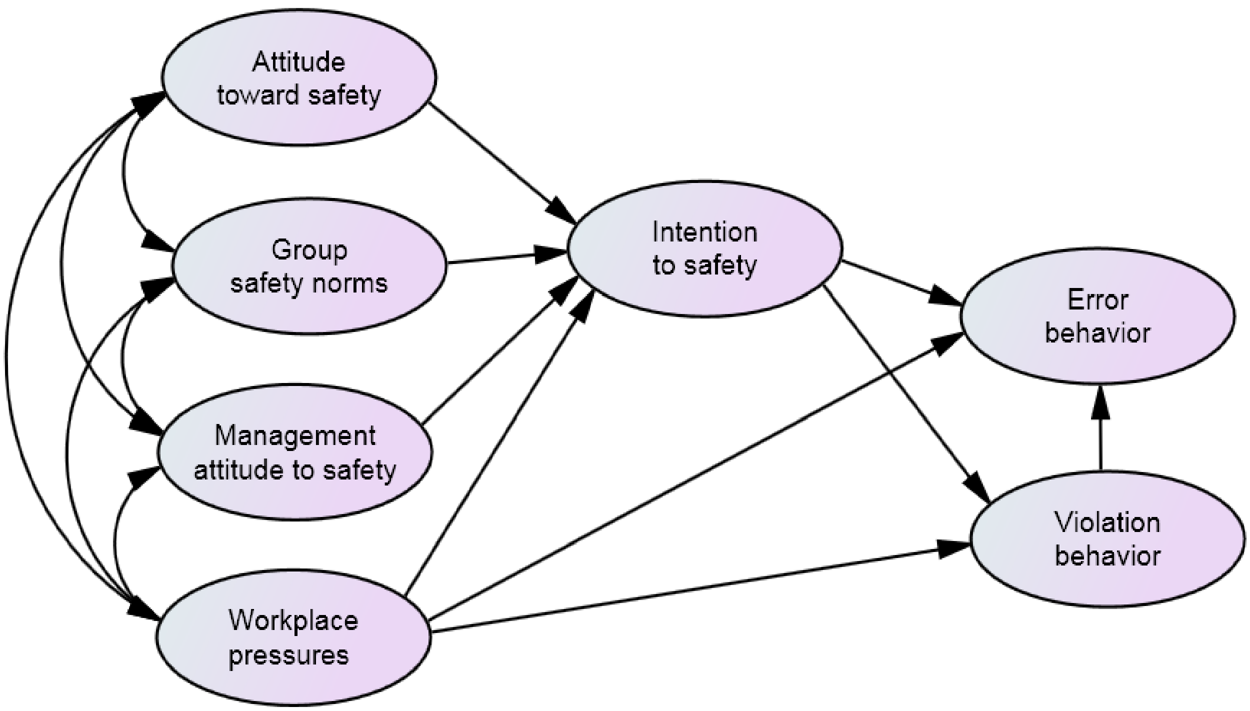

Figure 2. Conceptual Model of the Study Based on the Theory of Planned Behavior

As seen in Figure 2, the safety climate of an organization directly impacts individual intention. Predicted intention, together with workplace pressures, can predict violation and error behaviors. A significant relation between violation and error behavior was also proposed because violating regulations leads to errors. Within the TPB perspective, it can be proposed that organizational safety culture influences individuals' safety behavior. In other words, the organizational safety culture perceived by individuals can be used to predict individuals' actual safe or unsafe behaviors. The methodology of the study, including hypotheses, sampling, survey instrument, and statistical analysis, is detailed in the methodology chapter.

CHAPTER 3 METHODOLOGY

The purpose of the study was to examine the influence of organizational safety climate (exogenous variable) on an individual's safety behavior (endogenous variable) in the TNP Aviation Department. Safety climate and safety behavior are both multidimensional latent constructs that cannot be directly observed (Helmreich & Merritt, 2001; Mearns et al., 2001; Wiegmann & Shappell, 2003). Hence, both endogenous and exogenous variables were measured via the measurement models of their latent components. Safety climate is a multidimensional construct having four components. Management attitude, group norms, own attitude, and workplace pressures were conceptualized to measure the safety climate of the organization. Likewise, safety behavior was conceptualized as a multidimensional construct having two dimensions (Shappell et al., 2007; Wiegmann & Shappell, 2003). Violation and error behaviors were conceptualized to measure safety behavior.

The second purpose is to determine whether safety climate perceptions differ in regard to different job types, organization size, individual's rank, age, education level, service years, and flight hours. Identifying differences in the safety climate perceptions of employee subgroups can help us understand the formation of organizational subcultures (Glendon & Litherland, 2001). Hence, control variables were correlated with safety climate components to identify the differences existing among subgroups.

Third, the influence of personal and occupational attributes such as age, years of employment rank, education level, and flight hours on intentions regarding safety and safety

behavior was examined. The study's purposes led to the development of the hypotheses proposed below.

3.1 Statement of the Hypotheses

The following hypotheses are proposed to test the structural relations among the study variables. The study model proposes several relations among latent variables. However, management attitude, group norms, individual attitude, and workplace pressures were observed in order to measure the safety climate construct via a four-factor model as an exogenous variable. Violation and error behaviors were observed to measure the safety behavior construct by a two-factor model as an endogenous variable. Hence, the relation between safety climate perception and self-reported safety behavior was proposed as the first hypothesis. Accordingly, the safety climate of the organization positively affects an individual's safety behavior, as assumed in the literature (Hall, 2006; Fogarty & Shaw, 2009).

> *H_1: Police Aviation Department employees' safety climate perceptions positively affect their self-reported safety behaviors, holding demographic and organizational factors constant.*

The second hypothesis relates to safety behavior variances based on organizational and demographic variables. Testing the safety behavior variance helps us observe the influence of demographic and organizational attributes on the individual's safety behavior. The proposed direction of the third hypothesis is positive, because it is expected that experience (rank, age, service years, and flight hours) and education have positive effects on an individual's behavior. It

is proposed that age, rank, educational level, years of employment, and flight hours have a positive influence on self-reported safety behavior.

H_2: Organizational size, rank, age, educational level, service years, and flight hours are positively associated with self-reported safety behavior.

The third hypothesis relates to subgroup differences. To date, safety climate effects have only been studied on the individual level (Glendon & Litherland, 2001). However, different safety climate perceptions between the upper and lower hierarchical levels of management in the same organization were demonstrated by Zohar and Luria (2005). Determining sub-group differences helps us understand the formation of safety culture and establish targeted strategies based on subgroups' differences (Glendon & Litherland, 2001; Zohar & Luria, 2005).

H_3: There are differences among pilots, maintenance staff, and office staff based on their self-reported safety behaviors.

Three different subgroups work in the TNP Aviation Department. Pilots, maintenance personnel, and office staff encounter different job characteristics, instruments, policies, procedures, and practices when performing their job. Pilots not only fly the aircraft but are also commanders of flight missions. They perform the flight mission according to aviation traffic regulations and standard and emergency operational procedures. Reckless and unsafe behaviors are prevalent deviant pilot characteristics because of the nature of the professional culture (Kern, 1998). Maintenance personnel are accountable for the aircrafts' repair and periodic overhaul. However, they work primarily on the ground and do not participate in most of the flight. Maintenance personnel perform their jobs according to maintenance manuals and technical

procedures. Office staff performs supporting activities, which do not include aviation tasks. They are rarely expected to perform their tasks according to procedures specifically designed in an aviation and safety context. However, they are a crucial part of the organization; even minor errors on their part may cause extensive damage. One of the purposes of this study was to identify subgroup differences in safety behaviors. It was proposed that, pilots, maintenance personnel, and office staff have different safety behavior performance.

The fourth hypothesis is about the formation of the safety culture in an organization and its dimensions. Organizational safety culture is measured by its safety climate facet (Zohar & Luria, 2005). Safety climate defined as the shared perceptions of organization members regarding common attitudes in the workplace toward safety (Hall, 2006). Organizational safety climate is shaped by four dimensions including individual own attitude, group norms, management attitude, and workplace pressures. It is postulated that own attitude, group norms, and management attitude are positively correlated with each others, and negatively correlated with workplace pressures.

> *H_4: Regarding safety climate dimensions, individual own attitude, group norms, and management attitude are positively correlated with each others, and negatively correlated with workplace pressures.*

Confirmatory factor analysis with structural equation model was used to test the hypotheses above, because it has been proposed as the most appropriate statistical method for testing the relations between latent constructs (Byrne, 2010; Schumacker & Lomax, 2004). Validated measurement models of exogenous, endogenous, and mediating variables were

connected with control variables to identify the organizational and demographic variables that account for the variation in study constructs for testing the first two hypotheses. Task group variables were re-coded as three dummy variables to observe the subgroup differences in the third hypothesis.

Study variables are latent constructs, which require multiple indicators to observe. The measurement models of latent constructs were designed by multiple indicators considered in the literature. Operational definitions of the variables and brief explanations are presented in the next section.

3.2 Study Variables

The operational definitions of the study variables are illustrated in the table below. Safety climate is an exogenous variable having four components. Safety behavior is an endogenous variable designed as a two-factor model including violation and error components. Intention is the latent construct mediating the relation between organizational safety climate and individual safety behavior based on the TPB model. Table 1 indicates the dimensions of and explanations for the latent variables, as well as their measurement levels.

Table 1. Operational Definitions of Study Variables

Study Variables	Dimensions	Explanation	Measurement Level
Exogenous Variable			
Safety Climate	Own Attitude toward Safety	Individual's value expectancy of the safety issues.	Ordinal (5-point Likert S.)
	Group Norms	Fellows' beliefs and behaviors toward safety in the workplace	Ordinal (5-point Likert S.)
	Management Attitude	How individual perceive management commitment and support to safety issues	Ordinal (5-point Likert S.)
	Workplace Pressures	Pressures obstructing to follow safety procedures,	Ordinal (5-point Likert S.)
Endogenous Variable			
Safety Behavior	Violation Behavior	Willful disregard from the formal safety regulations and procedures	Ordinal (5-point Likert S.)
	Error Behavior	Activities accidentally failing to achieve intended outcomes	Ordinal (5-point Likert S.)
Mediating Variable			
Intention		Individual's intention to perform a safety behavior and follow a safety procedure	Ordinal (5-point Likert S.)
Control Variables			
Group		In which group are you working now?	Pilot, Maintenance, Office Staff
City		In which city are you working now?	Ankara, Istanbul, Diyarbakir, Izmir, Adana, Antalya
Rank		What is your rank?	Police Officer, Sergeant, Captain, Major
Age		What is your age?	Up to 30 years old, 30-39, more than 40
Educational		What is the highest degree you completed?	High School, college, BA, Master above
Years of Service		How long have you been in the TNP Aviation Department?	Less than 5 years, 6-10, 10-15, more than 15 years
Flight Hours		What is your total flight hour?	No flight, less than 500, 500-1000, 1001-1500, 1501-2500, more than 2500

The study variables and their explanations, dimensions, sources, and measurement levels are illustrated in Table 1. The study had seven latent variables. Safety climate perception was conceptualized with the guidance of Ajzen’s (1991) theory of planned behavior by using four latent constructs to explain the origins of an individual’s particular behavior. Likewise, safety behavior is conceptualized with the guidance of Wiegmann and Shappell’s (2001; 2003) human factor analysis and classification system by using violation and error constructs. Lastly, the intention construct was included in the model to strengthen the relation between the safety climate of the organization and an individual’s safety behavior (Ajzen, 1991; Fogarty & Shaw, 2009). Study variables were measured by using multiple indicators. The rationale behind each dimension is discussed in detail in the following topics.

3.2.1 Individual’s Own Attitude toward Safety

Individual’s own attitude toward safety refers to an individual’s own value expectancy for safety (Mearns et al., 2001; Fogarty & Shaw, 2009). *Attitude* refers to the feelings of an individual about something, which are evaluated and generalized according to individual’s personality. It in turn affects the individual’s actions and behaviors (Baron, 2008). The individual expects a positive or negative outcome associated with the intended behavior (Hall, 2006). The expectation about the behavior is a subjective value based on the individual’s assessment. However, the subjective value of the intended behavior leads an individual to develop an attitude toward the behavior because of the expected outcome. Hall (2006) identifies the strength of the individual’s own attitude, which primarily depends on the behavioral belief based on the subjective evaluation of the expected outcome. Own attitude indicators were designed to reflect

an individual's feelings toward work risks, safety tool usage, and safety commitment, as well as attitudes toward the necessity of safety regulations, safety violations, and errors.

Own attitude of the individual is considered one of the components of the safety climate construct and one of the predictors of intention in the theory of planned behavior (Ajzen, 1991; 2005). In the study model, it was suggested that an individual's own attitude had significant correlations with group norms, management attitude toward safety, and workplace pressures. An individual's own attitude toward safety had a direct influence on their intention to follow safety procedures and an indirect influence on violation and error behaviors mediated by the intention variable.

3.2.2 Group Norms

Group norms is the second component of safety climate, referring to a generally acknowledged way of performing a particular task (Baron, 2008; Fogarty & Shaw, 2009), as well as perceived social pressures in the workplace (Helmreich & Merritt, 2001; Hall, 2006). The rationale behind group norms is the presence of fellow workers' influence on an individual's attitude and intention toward any kind of behavior. Organizations do not have a homogenous and monolithic culture; rather, they contain many subcultures based on profession, age, educational level, and work performed (Helmreich & Merritt, 2001). The beliefs and behaviors of group members are most likely to influence the attitudes of individuals (Fogarty & Shaw, 2009). This argument resembles the assumptions of the symbolic interaction approach, which focuses on the interaction process occurring between an individual and other people within the environment (Schneider & Reichers, 1983). Events, regulations, policies, and procedures are interpreted by

individuals throughout group member interactions. Working in the same environment, doing the same job, socialization processes, and frequent interaction lead individuals to develop common norms over time. Negative norms or deviant versions of formal rules are more likely to be developed by group members (Helmreich & Merritt, 2001).

In the conceptual model, it was suggested that group norms had significant correlations with own attitude, management attitude, and workplace pressures. The rationale for the management influence was emphasized by Helmreich and Merritt (2001), who noted that management plays a central role in modifying and manipulating subgroups' norms by specifying expected behaviors. Moreover, it is management's job to make group members establish positive norms (Helmreich & Merritt, 2001). Second, it was suggested that perceived group norms had a direct influence on an individual's intention to follow safety procedures, and an indirect influence on violations and error behavior, mediated by the intention variable.

3.2.3 Management Attitude toward Safety

Management attitude toward safety is the third component of the safety climate, referring to management's commitment, devotion, and support to safety as perceived by individuals. The theory of planned behavior does not include the management's attitude toward safety (Garson, 2009; Hall, 2006). However, an individual's perception of managers' attitudes toward safety has been proposed as the most important predictor of organizations' safety climate (Zohar, 1980; Seo et al., 2004; Hall, 2006; Fogarty & Shaw, 2009). Hence, safety climate studies have highlighted the importance of management attitudes toward safety. In an empirical study, Helmreich and

Merritt (2001) surveyed pilots working at two airline companies to observe the variance in perceptions of management attitudes toward safety. While 84% of pilots working at one company were confident that management never compromised safety, only 12% of pilots working at the other company believed in the management's commitment to safety (Helmreich & Merritt, 2001). The authors emphasized that management attitudes influence pilots' attitudes regarding safety practices and norms. Indeed, 68% of pilots working at the first company believed that management would seriously consider their safety suggestions, compared with 19% of the pilots working at the second company (Helmreich & Merritt, 2001).

The causal mechanism of management attitudes' influence on pilot behavior can be explained by the second company's environment. Up to 88% of pilots working at the second company believed that the management compromised safety for the sake of profit. Moreover, they believed that management ignored their suggestions to improve the organization's safety processes. Demoralized and cynical pilots are likely to be more willing to deviate from safety procedures and norms (Helmreich & Merritt, 2001). In other words, pilots develop an attitude favoring low safety standards, because it is difficult to maintain high safety standards when perceiving management to have low standards. Westrum (1996) claims that management's signals about safety priorities are noted by aviators so that they can comply with rewarded behaviors.

Management attitude toward safety was included in the conceptual model as a component of safety climate and a predictor of intention and safety behavior. In the conceptual model, it was suggested that management attitude toward safety had significant correlations with individual's

own attitude, group norms, and workplace pressures. Second, management attitude had a direct influence on individuals' intentions to follow safety procedures, and an indirect influence on violation and error behaviors, mediated by the intention variable.

3.2.4 Workplace Pressures

The last component of the safety climate is *workplace pressures*, referring to the perceived ease or difficulty of the safety procedures followed by individuals. This perception is formed from workers' experiences and anticipated obstacles (Hall, 2006). This safety climate component is also related to the availability of appropriate instruments and procedures in the organization. The theory of planned behavior supposes that individuals' behaviors are strongly influenced by their perceived confidence in their ability to perform them (Ajzen, 1991; 2005). In other words, when individuals agree with the reliability of procedures, coherence of instruments, and convenience of following regulations, workplace pressures remain at the minimum level. Individuals may have a strong intention to perform a safety behavior or follow safety procedures; however, actual performance is shaped by the influence of exterior factors, such as workplace pressures (Fogarty & Shaw, 2009). Examples of workplace pressures include lack of time, personnel, equipment, and production pressures. According to Baron (2006), company, customer, peer, and self-induced pressure can influence individuals as workplace pressures.

The presence of workplace pressures was suggested to be a component of safety climate, and also to be a predictor of intention, violation, and error behaviors. The theory of planned behavior assumes that workplace pressures have direct and indirect effects on safety behavior

(Ajzen, 1991; 2005). In the conceptual model, it was suggested that perceived workplace pressures had significant correlations with own attitude, group norms, and management attitude variables. It was assumed that management has a strong influence on individuals' perceptions about workplace pressures. Second, workplace pressures had a significant direct influence on individual intention. Third, workplace pressures had a significant direct influence on violation and error behaviors, as well as an indirect influence on violation and error behaviors, mediated by the intention variable. Ajzen's (1991; 2005) theory of planned behavior suggests that an individual's intention, together with perceived workplace pressures, can predict the individual's safety behavior. It can be concluded that holding intention constant, workplace pressures are the principal predictor of violation and error behaviors.

3.2.5 Intention toward Safety Behavior

Intention refers to motivational factors, which influence performing a behavior (Ajzen, 1991). Intentions "are indications of how hard people are willing to try, of how much effort they are planning to exert, in order to perform the behavior" (Ajzen, 1991, p. 181). The intention construct was conceptualized to observe an individual's intention toward safety commitment, pre-checking, safety processing manipulation, risk-taking behaviors, and safety perspectives. The intention variable was included in the model to mediate the relation between safety climate and safety behavior. The theory of planned behavior identifies the intention as an outcome of three variables: own attitude, group norms, and workplace pressures (Ajzen, 1991). Intention, together with workplace pressures, is accounted for by safety behavior.

The rationale behind the intention construct can be explained by the variation between intention and behavior. Ajzen (1991) speculated that individuals cannot constantly realize their intentions because of several exterior factors that prevent the attitude from expressing as a behavior. Therefore, intention is included in the model to strengthen the relation between attitude and behavior (Fogarty & Shaw, 2009). In this way, individual attitude, group norms, management attitude, and workplace pressures are observed to predict the individual's intention, which in turn, with workplace pressures, will predict the behavior. Intention can be considered a mediating variable to strengthen the relation between behavior and attitude (Fogarty & Shaw, 2009).

Intention is the mediator variable of the conceptual model. It was suggested that an individual's intention toward safety was influenced by the safety climate. Individual intention had a direct significant influence on violation and error behavior. A stronger intention toward a safety behavior means that the individual is more likely to perform that behavior safely and less likely to violate safety procedures and make safety errors.

3.2.6 Violation Behavior

Safety behavior is the latent endogenous variable, and has two dimensions. *Violation* refers to willfully and consciously disregarding approved safety regulations and procedures (Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003; Shappell et al., 2007). Two distinct forms of violation are defined in the literature (Reason, 1990; Wiegmann & Shappell, 2003; Shappell et al., 2007). Routine violations are habitual activities that are often tolerated by the

system and by supervisors. “Bending the rules” is a common expression used to identify routine violations. For example, driving an automobile consistently at five to ten miles above the allowed limit is a routine violation. The system (local authorities and law enforcement) often tolerates and does not enforce punishment for this kind of behavior (Wiegmann & Shappell, 2001; 2003). However, such tolerance does not change the reality that it is a violation behavior. *Exceptional violation* is the second form of violation, referring to isolated departures from authority. As an example, driving 100 mph in a 45-mph zone is considered exceptional because of the appalling and highly dangerous nature of the behavior (Wiegmann & Shappell, 2001; 2003). The system certainly does not condone exceptional violation behaviors.

Violation behavior was observed via questions observing individuals’ own assessments of their behaviors—the extent to which they bent the rules to complete a task faster, performed tasks without checklists, preferred shortcuts, and believed in the safety regulations and procedures. Safety behavior was conceptualized as a two-factor model including violation and error components. It was suggested that violation had a significant correlation with error behavior. In the conceptual model, violation had a significant influence on error behavior, meaning that the more individuals violated safety procedures, the more safety errors they made. For the violation variable, predicted intention by organizational safety climate variable together with workplace pressures had a significant influence on violation behavior.

3.2.7 Error Behavior

Error behavior is the second dimension of safety behavior, referring to an individual's accidental failure to achieve an intended outcome (Wiegmann & Shappell, 2001; 2003). Error behavior can be classified into decision errors, skill-based errors, and perceptual errors. *Decision errors* refer to honest mistakes, which are often committed due to improper choices, poorly executed procedures, or misuse or misinterpretation of related information (Wiegmann & Shappell, 2001; 2003). *Skill-based errors* occur when unintentional attention and memory failures occur. Forgotten intentions, omitted items in the checklists, and accidental activation of switches are examples of skill-based errors. Lastly, *perceptual errors* occur when working in unusual conditions, such as flying at night, in extreme weather conditions, or completing rarely performed tasks (Wiegmann & Shappell, 2001; 2003).

Error behavior was measured by questions targeted to observe individuals' own assessments of their competence and knowledge about safety, as well as the extent to which they made errors during rarely performed tasks. Error behavior is the second component of individual safety behavior because unsafe behaviors were performed either by violating safety procedures or by accidentally failing to achieve an intended outcome (Wiegmann & Shappell, 2001; 2003).

The two-factor measurement model of safety behavior suggested that a significant correlation existed between the violation and error variables. Second, violation, intention, and workplace pressures had a significant influence on the error variable.

3.2.8 Control Variables

Based on the safety culture and safety behavior literature, generally accepted personal and occupational attributes of TNP Aviation Department members were used as control variables. Task group, city, rank, age, education, years of service, and flight hours were included in the study model to test their influence on the individual's safety behavior. A positive correlation was suggested between the demographic and organizational variables, as well as individual safety behavior, because it was expected that experience and education positively influenced individuals' behavior.

3.3 Sampling

The population of the study consisted of members of the Turkish National Police (TNP) Aviation Department. The unit of analysis of the study was individual TNP Aviation Department employees. The TNP Aviation Department has its headquarters in Ankara and five regional units serving the various geographical regions of Turkey. Aviation units are placed in Turkey's largest regional cities, including Istanbul, Diyarbakir, Izmir, Adana, and Antalya. These units are coordinated and administered from the central agency in Ankara, meaning that the organization consists of a single hierarchical structure that serves the entire country. The top-level management personnel in Ankara are accountable for assigning personnel and helicopters to regional units. However, operational command in the regional units belongs to the city police manager. Three subgroups—police helicopter pilots, maintenance personnel, and office staff—work in the TNP Aviation Department. These three types of personnel, serving in six cities,

permitted the observation of group differences as well as regional office differences in terms of safety performance variance.

The study questionnaire was distributed to the majority of TNP Aviation Department personnel because there are approximately 300 personnel in the department. The entire population of the TNP Aviation Department was targeted by the study. Hence, the study results represented almost the entirety of the studied organization. Between 60 and 100 individuals from each subgroup were included in the study survey. The representation of subgroups was important to observing group differences. For this purpose, 300 subjects, consisting of 60 to 80 helicopter pilots, 90 to 120 maintenance personnel, and 100 to 120 office staff, were targeted for the study. Several strategies were used to reach almost all TNP Aviation Department members. First, the top management was conferred with to acquire their permission and support. Second, fellow personnel were assigned from each unit to ensure a high participation rate. Employees were informed of the study topic and purposes through safety meetings, which are held once a month and attended by all unit members. A response rate adequate for the study's power analysis was expected.

3.4 Power Analysis and Sample Size Justification

Power analysis provides an estimation of the sample size needed for the model. The concept of power can be defined as the likelihood of rejecting the null hypothesis when the null hypothesis is in fact false (Kaplan, 1995). Power analysis depends primarily on the confidence level considered for the study. This study had an alpha level of 0.05 (the confidence level),

which determines the p value. The results of this study made the researcher 95% confident in drawing the conclusion that the results ensure the integrity of the study.

Several arguments have been proposed regarding the necessary sample size of a covariance structure model. Boomsma and Hoogland (2001) claimed that 200 cases constitute a reliable sample size for a correct model—one in which any problem related to power analysis is less likely to occur. On the other hand, smaller samples have also been used in the literature. According to Hox & Bechger (1998), maximum-likelihood estimation requires larger samples: At least 400 cases are needed to ensure enough power for the analysis. Kline (2005) claimed that sample size estimation should be made based on the number of parameters. While a ratio of 10 respondents per parameter is reasonable, a ratio of 20 respondents per parameter ensures adequate power for the analysis (Kline, 2005). For this study, the targeted organization was a relatively small organization comprising approximately 300 employees. Hence, the necessary sample size was suggested based on Bentler and Chou's (1987) general rule for structural equation modeling sample size estimation. The authors argued that five times the number of the parameters should be the minimum sample size of the study (Bentler & Chou, 1987). Since the study had almost 40 parameters, a minimum of 200 study subjects would ensure enough power for the analysis. Indeed, similar structural equation models were tested with 308 participants in Fogarty and Shaw's (2009) study and 270, 302, and 383 participants respectively in Hall's (2006) studies.

3.5 Data Collection

The purpose of the study was made clear to the study participants, who were expected to be familiar with the study's concepts because of their occupation. An informed consent form was provided to all participants prior to their participation in this study. This form provides information about participants' confidentiality as well as information about the purpose of the study. Participation in this study was voluntary.

The survey was uploaded to a website in order to reach TNP Aviation Department personnel located in six cities. The web link for the survey was sent to participants by e-mail, as all regional police aviation offices provide Internet access to their personnel. Three e-mail follow-ups were forwarded to non-respondents at two-week intervals to maximize the response rate. The study's researcher has worked in the TNP Aviation Department as a police helicopter pilot for seven years. Utilizing this organizational connection, several colleagues were assigned to follow the data collection process to encourage organization members to participate in the study. As a result, the data collection process took place without any major problems.

3.6 Human Subjects

Federal law requires Institutional Review Board (IRB) approval because the study uses human subjects. This requirement ensures the protection of individuals' rights and interests. This study involved no risk of harm to its subjects. Participants were invited to participate in the study on a voluntary basis. Consent forms were obtained before conducting the study. As well, personal information regarding human subjects had to remain anonymous, which means the

researchers had to keep individuals' identities confidential. The survey questions in this study did not include personal information; rather, it utilized demographic variables and the perceptions of employees regarding specific issues. Respondents were coded with a sequential number based on their participation order, but no link between the respondents' identities and their number existed in the data. Study data, including survey responses and the demographic and organizational variables of the individuals, were stored securely.

3.7 Survey Instrument

Studies on human factors in aviation have used either retrospective incident/accident reports or employee perceptions to measure study concepts (Maurino et al., 1995; Wiegmann & Shappell, 2003; Li & Harris, 2006). However, it has been argued that retrospective incident/accident reports are subject to inaccurate measurement because of inconsistent reporting by performers and biased information (Helmreich & Merritt, 2001). Human factor measurement models based on accident or incident reports have several research issues to overcome. First, the incidence of a single aviation accident does not mean that an organization has an unreliable or negative safety culture. Likewise, a low accident rate in an organization does not mean it has a highly reliable safety culture (Helmreich & Merritt, 2001). Accidents are infrequent events, especially for aviation organizations, that do not reflect organizational safety culture. Accident and incident reports focus on outlier events, which may not provide an accurate measurement of the study's concepts. Hence, the evaluation of individuals' perceptions was preferred in measuring study concepts based on the theoretical model. A survey questionnaire was developed for this study.

The survey questionnaire was developed by evaluating questions from three surveys designed by Seo et al. (2004), Hall (2006), and Fogarty and Shaw (2009). Written permission to use the relevant questions was obtained from the author of each study. Questions were selected from these surveys because each survey has both strong and weak aspects, as the authors expressed in their studies. While Fogarty and Shaw (2009) focused solely on the violation side of human error, Hall (2006) did not conceptualize "safety behavior" in his study but used "intention" as the endogenous variable. Lastly, Seo et al. (2004) did not include an "intention toward safety" variable. All three surveys have different reliability scores ranging from 0.70 to 0.94. This study's new safety climate measurement instrument utilized the strongest aspects of these three surveys.

Several criteria were determined for the question selection process. Among identical items from the three surveys, short and clear items were preferred. Double-barreled items, ambiguous items, items with multiple negatives and difficult vocabulary, and lengthy items were avoided to reduce redundancy and promote clarity (Babbie, 2008). The national and professional cultures of the TNP Aviation Department were considered for the selection process (Helmreich & Merritt, 2001). A couple of negatively worded questions were included to test the robustness of the instrument (Babbie, 2008). Each latent construct of the study model was conceptualized by identifying its observable dimensions. For example, the theoretical model of the study contained seven latent variables: management attitude toward safety, individual's own attitude toward safety, group norms, perceived work pressures, intention, violation, and error behaviors were all measured by survey questions. Management, individual, and group attitudes regarding safety were conceptualized through six dimensions: 1) devotion, 2) support, 3) reporting, 4) leading, 5)

attendance, and 6) prioritization (Minvielle et al., 2005). Questions were selected from three surveys to observe these dimensions. The question selection process for each latent construct is discussed below.

Individual attitude was conceptualized by using Hall's (2006) risk items and Fogarty and Shaw's (2009) "own attitude toward violation" items. The attitude toward safety and commitment to safety items were included from the Hall (2006) survey. The individual's own attitude construct was observed via seven items, regardless of the internal consistency reliability score; the methodology of the construct was considered robust enough to support this approach.

Perceived group norms questions were selected from Seo et al.'s (2004) coworkers' support construct, which had a 0.78 Cronbach's alpha score. However, one of the six questions was removed because of cultural nonconformity. Another item from Seo et al.'s (2004) coworker's support construct was modified to ensure the item's conformity with Turkish culture. The original item was "Employees feel it is important to recognize and report near miss incidents." The item was replaced with "Employees feel it is important to discuss/elaborate upon near miss incidents" because reporting on peers is culturally not considered appropriate among fellows working in the same organization. Two items were included in the group norms construct to enable the observation of the commitment and prioritizing dimensions. Finally, the group norms construct measurement instrument contained eight items.

The management attitude toward safety construct was observed via nine items selected mostly from Seo et al.'s (2004) survey based on six dimensions. Seo et al. (2004) reported the Cronbach's alpha score of this construct as 0.84. However, several items were found to be

identical. Moreover, perceived supervisory support was considered part of management attitude. Two items observing supervisory support were included in the management attitude construct because the supervisor could have a different attitude from the management.

Perceived work pressures was conceptualized with six dimensions, including perceived time pressures, excessive workload, tradeoff power of safety against performance and task, implementation difficulty of safety regulations, individual's competence to safety, and attainability of safety instruments in the organization. Questions were mostly selected from Seo et al.'s (2004) perceived work pressures construct, which had a scale of seven items and a Cronbach's alpha score of 0.88. The first item, "Production is given a higher priority than safety," was replaced with "Getting the task done is given a higher priority than safety" because the TNP Aviation Department does not produce goods but rather performs tasks. Among the identical items referring to time pressures, a couple of items were preferred based on the selection criteria mentioned above. Two new items were included to observe individuals' competence in safety and the attainability of safety instrument from the organizational resource. The workplace pressures construct contained seven items.

Intention was included in the model as a mediating variable to strengthen the relation between perceived safety climate and self-reported safety behavior. Intention was observed via six items derived from questions designed by Hall (2006) and Fogarty and Shaw (2009). Self-reported safety behavior, an endogenous variable of the study, was conceptualized via the human factors analysis and classification system developed by Wiegmann and Shappell (2001; 2003). Accordingly, individual safety behavior in the workplace can be classified into two categories.

While “error” refers to legal activities that fail to achieve the intended outcome, “violation” represents willful disregard for formal safety regulations and procedures (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001). Violation items were designed to observe routine and exceptional violations, of which Fogarty and Shaw’s (2009) violation items were preferred. For the error construct, questions reflecting the decision, skill-based, and perceptual error dimensions were selected from Seo et al.’s (2004) unsafe behavior construct based on the error definitions (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001). The violations construct contained five items and the error construct contained four items to enable the observation of individuals’ safety behavior in the workplace.

The survey questionnaire contained three sections. The first section aimed to measure safety climate dimensions, including own attitude, group norms, management attitude, and workplace pressures components. This section had 31 questions. The second section sought to measure intention variable and safety behavior dimensions, including violation and error behavior. This section had 15 questions. Participants were asked to respond to questions by using a five-point Likert scale: “(1) Strongly agree,” “(2) Agree,” “(3) Neither agree nor disagree,” “(4) Disagree,” and “(5) Strongly disagree.” The survey questions were translated into Turkish to ensure that respondents would comprehend the questions accurately. The Turkish version of the survey was checked by Dr. Kapucu, who is a native Turkish speaker and one of the committee members for this study. Dr. Ozmen and Dr. Yalcinkaya, experienced police helicopter pilots, were asked to check the appropriateness of the translation because of their familiarity with the study’s concepts.

The last section was established to measure demographic and occupational variables such as task group, assigned city unit, rank, age, educational level, years of employment, and flight hours. The task group variable contained three subgroups, including office staff (1), maintenance personnel (2), and pilot (3). The study survey was conducted in six cities, including Antalya (1), Adana (2), Izmir (3), Diyarbakir (4), Istanbul (5) and Ankara (6). Numbers were assigned to cities based on organizational size. The main body of the organization is in Ankara, so this city has the largest organizational size and the largest number of personnel. Istanbul is the most populous city in Turkey and has the second largest organization size. Diyarbakir is the largest city in southern Turkey and has the third biggest organization. Izmir, Adana, and Antalya are the largest cities in their regions and have relatively smaller organization sizes. Aviator rank was asked to determine respondents' level in the hierarchy. Police officer (1), sergeant (2), captain (3), and major (4) were the rank categories. The age of the police aviators was scaled into three categories including "up to 30 years old" (1), "between 30 and 40 years old" (2), and "more than 40 years old" (3). High school (1), college (2), bachelor's degree (3), and master's degree and above (4) were the educational level subcategories that determined the educational variance of the respondents. The years of employment variable was scaled into four categories including "less than 5 years" (1), "between 5 and 10 years" (2), "between 10 and 15" (3), and "more than 15 years" (4). The flight hours variable was scaled into six categories including "no flight" (0), "less than 500 hours" (2), "between 500 and 1000 hours" (3), "between 1001 and 1500 hours" (3), "between 1501 and 2500 hours" (4), and "more than 2500 hours" (5).

3.8 Statistical Analysis

The statistical analysis of the study was conducted on the four main topics and included descriptive analysis, confirmatory factor analysis, structural equation modeling, and hypotheses testing. The methods preferred for each analysis were detailed below.

3.8.1 Descriptive Analysis

The descriptive analysis was presented via frequency tables for control, with exogenous and endogenous variables displayed separately to identify the distributional properties of the survey data. Two different correlation matrices were generated through the descriptive analysis. First, correlations between latent indicators and control variables were presented in order to delineate the relationships between the indicators and control variables proposed, and the strength as well as the direction of the relationship if any existed. Second, correlation matrixes were created to observe the association among latent indicators for an initial check to identify the multicollinearity problem. The most popular ordinal measures of association, Spearman rho and gamma tests, were conducted to analyze the correlations (Agresti & Finlay, 2009). While Spearman rho is conducted on continuous ordinal data having a relatively broad range of categories, gamma is more appropriate for collapsed variables, in which all observations are classified in a limited number of response categories. The gamma test was preferred for analyzing the correlations, as the measurement level of variables were collapsed ordinals ranging on a five-point Likert scale. The gamma test generates a value falling between -1 and +1. While the sign of the value indicates the direction of the association, the magnitude of the gamma

number indicates the strength of the association, where an absolute value of gamma closer to 1 indicates a stronger association (Agresti & Finlay, 2009). The pattern of relationship and percentage distributions were also provided by the gamma coefficient.

Second, multicollinearity, which is a problem in measuring social research, was examined. Multicollinearity arises when the intercorrelations between at least two variables are too high. Kline (2005) suggested that multicollinearity can happen when theoretically separate variables (or variables that ought to be separate theoretically) actually measure the same phenomenons. The most widely used cutoff points are .80 and .90; a correlation score among variables higher than these numbers can signal multicollinearity (Kline, 2005). The initial check to identify multicollinearity problem was made using the Spearman rho correlation test to detect high correlations (those having more than .80 coefficient values).

3.8.2 Confirmatory Factor Analysis

The second part of the statistical analysis consisted of confirmatory factor analysis (CFA). CFA is an extension of factor analysis, which evaluates the validity of measurement models (Hox & Bechger, 1998; Wan, 2002; Byrne, 2010). CFA is a powerful tool for validating the measurement models of latent constructs (Wan, 2002; Schumacker & Lomax, 2004). *Model validation* refers to the degree to which the proposed measurement model measures what it is intended to measure (Trochim, 2001). Latent variables, often called constructs, are variables that cannot be directly observed, but can be measured by their observable indicators (Schumacker &

Lomax, 2004; Byrne, 2010). The study had four endogenous factor variables, two exogenous factor variables, and one latent mediating variable.

CFA was used to develop and validate the best measurement models by revising and improving generic measurement models. A three-stage approach was followed step-by-step, as suggested by Wan (2002). The first stage involved identifying the appropriate indicators by assessing critical ratios and standardized regression weights. Significance and adequate factor loading are two criteria in identifying the appropriate indicators. First, critical ratio is used to specify the significance of the standardized regression weights, which equals the estimate divided by its standard error (Wan, 2002; Schumacker & Lomax, 2004; Byrne, 2010). Indicators are postulated to be significant if the critical ratio value is equal to +1.96 or higher and -1.96 or lower at the preferred .05 level (Hox & Bechger, 1998; Byrne, 2010).

Second, the estimate power of factor loading was assessed. Factor loading (standardized regression weights) refers to the extent to which the indicator (observed variable) is related to the latent construct (unobserved variable) (Byrne, 2010). “A one-way arrow between two variables indicates a postulated direct influence of one variable on another” (Wan, 2002, p. 95). The absolute value of factor loading reflects the strength of the association between the latent construct and its indicator. While high values indicate strong relationships, low values indicate a negligible association and can be removed from the model to increase the measurement validity. For factor loadings, .50 was established as a cutoff threshold. Indicators having factor loadings lower than .50 were excluded from the measurement models.

The second stage involved determining how well the model fit with the study data. Evaluating the measurement model's overall fit involves assessing whether the model fit is within acceptable limits despite having significant and high factor loadings. Indicators having not statsitically significant factor loadings were dropped from the model, and the measurement errors of factor loadings were correlated depending on the theoretical framework (Hox & Bechger, 1998; Wan, 2002). In the measurement models, one indicator was selected as a scale factor in order to derive factor loading estimates for other indicators. The AMOS (Analysis of Moment Structures) software produced goodness-of-fit statistics to assess whether the measurement model fit the data. A fitting model means that the difference between the sample covariance matrix and the model-implied covariance matrix is small enough (Wan, 2002; Schumacker & Lomax, 2004). The similarity of the matrixes is interpreted as the data's fitting the theoretical model.

Several parameters have been used in the SEM literature for assessing model fitness including chi-square statistics and fit indexes. There is no consensus as to which fit indices to report. However, reporting all of them is not recommended, while using at least three fit tests was recommended (Garson, 2009). The determination of fit indexes and the rules-of-thumb cutoff criteria were the most important issues for many researchers (Hu & Bentler, 1999). The goodness-of-fit indices and index criteria selected for this study were based on Garson's (2009) recommendations.

The most widely used ways to evaluate model fit are the chi-square goodness-of-fit statistics and fit indexes. Modeling chi-square goodness-of-fit statistics is the most common fit

test for assessing the magnitude of discrepancy (Hu & Bentler, 1999). The chi-square test compares the given model's covariance structure with the observed covariance matrix. A lower chi-square value means that the model fits better with the data (Hu & Bentler, 1999; Kline, 2005). A significant chi-square value indicates the lack of a satisfactory model fit (Wan, 2002; Garson, 2009). However, the chi-square test is sensitive to the size of the correlations because larger correlations lead to greater differences between the given and observed covariance matrixes (Kline, 2005). Hence, normed chi-square statistics are used to reduce the sample size effect. A ratio of chi-square and degrees of freedom (CMIN/DF) as high as 4.0 is preferred as the cutoff level for considering reasonable fitness (Kline, 2005).

The second way of evaluating model fit is via so-called fit indexes, which can be classified into absolute and incremental fit indexes. An absolute fit index evaluates how well an *a priori* model produces the sample data (Hu & Bentler, 1999). The root mean square error of approximation (RMSEA) and Hoelter's critical N were selected among the absolute goodness-of-fit tests because the test has been reported as the most sensitive index for maximum likelihood (ML) based tests (Hu & Bentler, 1999). All measures overvalue goodness of fit for samples below 200, though RMSEA is less sensitive to sample size than others (Garson, 2009). Hence, RMSEA is a popular parameter that "measures the degree of model adequacy as based on population discrepancy in relation to degrees of freedom" (Wan, 2002, p. 82). While an RMSEA value below .05 indicates good model fit, a value between .05 and .08 is acceptable (Wan, 2002). Hu and Bentler (1999) suggested .06 as the cutoff value for RMSEA. Likewise, p-close assesses whether the RMSEA score is less than .05; a p-close value higher than .05 indicates a close model fit (Wan, 2002). Second, Hoelter's critical N is used to compute the minimum sample size

for accepting the model by chi-square at the .05 level. While a Hoelter's critical N below 200 is reasonable for accepting a model by chi-square, a value below 75 is considered unacceptable (Wan, 2002; Garson, 2009).

In contrast to absolute-fit indexes, incremental-fit indexes calculate the proportionate improvement in fit by comparing the null model, in which all the observed variables are typically uncorrelated, with the theoretical model (Hu & Bentler, 1999). The comparative fit index (NFI) and Tucker Lewis index (TLI) were selected among the incremental fit indexes to assess the improvement in fit because the goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) are not recommended for evaluating model fit due to poor performance (Hu & Bentler, 1999; Garson, 2009). CFI, also known as the Bentler comparative fit index, compares the best fitting model with the null model to reflect the proportion of improvement. A CFI value of .50 indicates that the revised model improves fit by 50% compared to the null model. While CFI values above .95 are good, values between .90 and .95 are acceptable (Hu & Bentler, 1999; Garson, 2009). The Tucker Lewis index (TLI) is a fit index that is less sensitive to sample size. A TLI score close to 1 indicates a good fit, while a score greater than .95 is the generally accepted cutoff for a good model fit; a score below .90 indicates the need to restructure the model (Hu & Bentler, 1999). Given the goodness-of-fit statistics, model fit was assessed based on the selected criteria (Hox & Bechger, 1998; Schumacker & Lomax, 2004). The fit indices used for this study are outlined in the table 2.

Table 2. Goodness-of-Fit Indices and Criteria for Model Validation

Index	Estimation Approach	Criterion
Chi-square (x^2)	magnitude of discrepancy between observed and predicted relationships among measures (Hu & Bentler, 1999)	The discrepancy should be minimal
Degrees of Freedom (df)	number of sample moments minus number of distinct parameters to be estimated (Wan, 2002)	greater than or equal to 0
Likelihood Ratio (x^2/df)	sample covariance matrix is drawn from the population as characterized by the hypothesized covariance matrix (Wan, 2002)	smaller than 4.0 suggests a good fit
P value	significance of chi-square (Hu & Bentler, 1999)	a non-significant value (>0.05) is desired
Tucker Lewis Index (TLI)	also known as NNFI, compares alternative models (Hu & Bentler, 1999)	>0.90 suggest a good fit
Comparative Fit Index (CFI)	compares the best fitting model and the null model (Hu & Bentler, 1999)	>0.90 suggest a good fit
Root Mean Squared Error of Approximation (RMSEA)	degree of model adequacy based upon population discrepancy respecting degrees of freedom (Wan, 2002)	smaller than 0.05 suggests a good fit
Probability (p-close)	test the population RMSEA is no greater than 0.05 (Wan, 2002)	>0.05 suggests a close fit
Hoelter's Critical N (CN)	evaluates the sample size to determine the largest sample to confirm that the model is correct using x^2 (Wan, 2002)	greater than 200

After assessing goodness-of-fit parameters, the third stage, identifying the possible reasons of lack of fit, was launched (Wan, 2002). Eliminating indicators not contributing to the measurement and freeing parameters based on their modification indices are possible solutions

for improving the model fit. The modification index of a particular parameter indicates that when this parameter is allowed to be free, the value of the chi-square decreases by at least the value of the index (Wan, 2002; Schumacker & Lomax, 2004). The AMOS program reported modification indices for all non-free parameters. The structural paths were inserted based on the modification indices to further improve the model fit. At each step, one pair of error terms with the largest improvement in the model was correlated by a two-way arrow, which “indicates that they are correlated” (Wan, 2002, p. 95). This process was repeated until the model showed a reasonably good model fit.

Lastly, the internal consistency of the instruments was tested by obtaining Cronbach’s alpha scores after the validation of the measurement models. SPSS version 16 produced Cronbach’s alpha scores for the measurement instruments. As a general rule, values of .70 and above are regarded as reliable (Bland & Altman, 1997). Reliability analysis demonstrated the consistency of the measurement instrument used.

3.8.3 Structural Equation Modeling

The third part of the statistical analysis consisted of structural equation modeling (SEM). After validating the measurement models, a covariance structure model was created and validated based on the goodness-of-fit statistics. The measurement model and covariance structure model are two main parts of the structural equation model (Hox & Bechger, 1998; Schumacker & Lomax, 2004). SEM consists of measurement models of exogenous and endogenous variables, as well as control variables. The validated measurement models were

connected with each other based on the theoretical framework of the study to test organizational safety climate's effects on individual safety behavior. Control variables were included in the model to identify the organizational and demographic variables that account for the variation in the study construct. The following figure illustrates the structural equation model of the study.

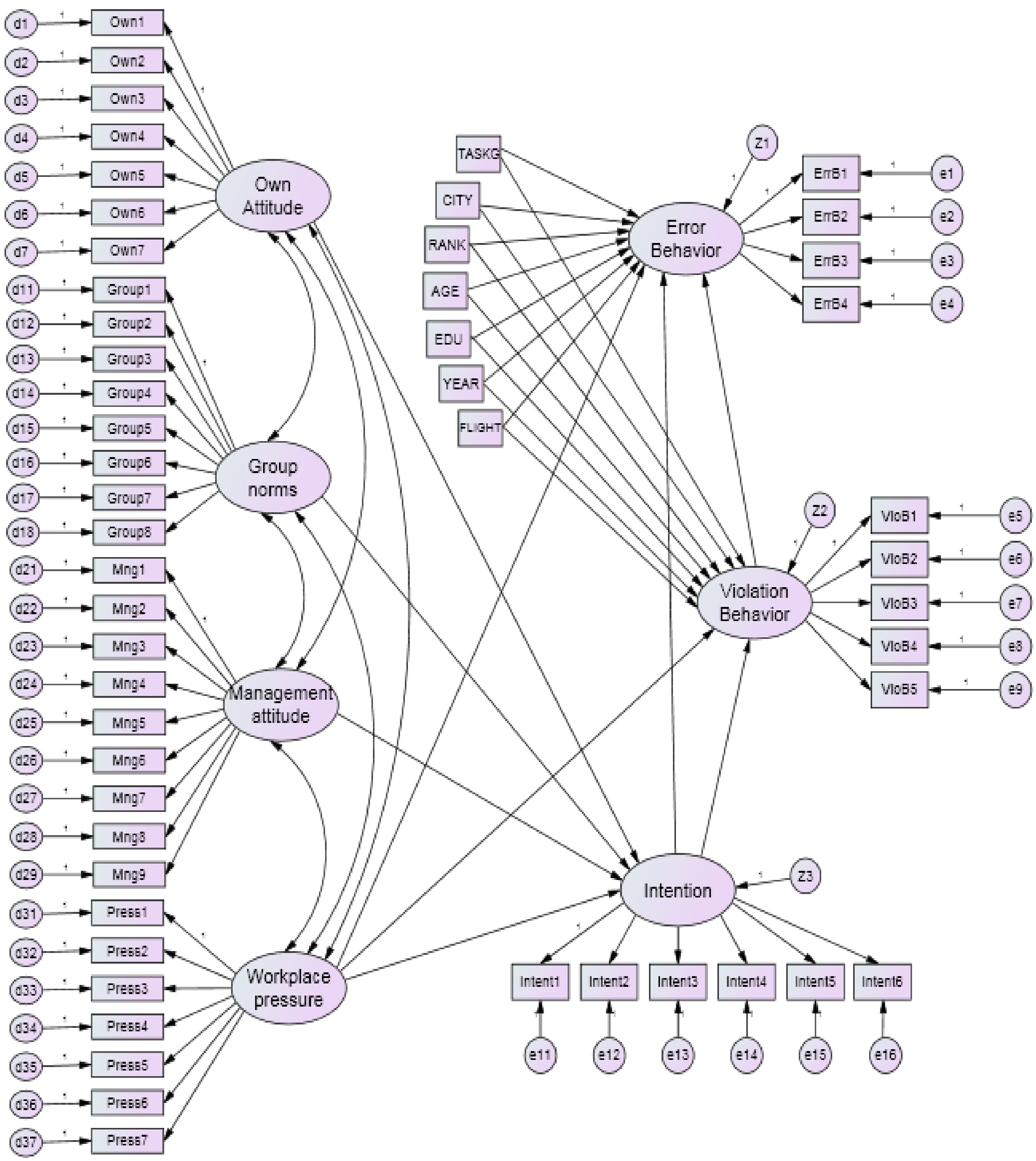

Figure 3. Structural Equation Model for Safety Behavior

This study had seven latent constructs, including management attitude toward safety, own attitude toward safety, group norms, workplace pressures, intention, violation behavior, and error behavior. While safety climate is an exogenous variable conceptualized as a four-factor measurement model, safety behavior is an endogenous variable conceptualized as a two-factor measurement model. After the validation of the measurement models for the study variables, a covariance structure model was developed to observe the effects of the exogenous variables on the endogenous variable. Control variables were also included in the covariance structure model to identify the possible causal relations of the study variables (Hox & Bechger, 1998; Schumacker & Lomax, 2004). The theoretical framework of this study proposes that organizational safety culture has a positive effect on individuals' safety behavior. The last part of the statistical analysis consisted of the hypotheses testing section. Four hypotheses were tested based on the results of the structural equation model. In the following section data analysis was conducted through four steps including descriptive statistics, confirmatory factor analysis, the structural equation model, and hypotheses testing.

CHAPTER 4 FINDINGS

The methodology of the findings chapter was developed based on four main topics: descriptive statistics, confirmatory factor analysis, the structural equation model, and hypotheses testing. A descriptive analysis of the study was created by using frequency tables for the control, exogenous and endogenous variables separately to identify the distributional properties of the survey data. Then a correlation matrix was conducted for each latent construct to observe the association between indicators and control variables. Correlation matrixes were also used to check for a possible multicollinearity problem.

The second main topic was established for three purposes. The application of structural equation modeling starts with the specification of a measurement model (Hu & Bentler, 1999). Confirmatory factor analysis was conducted for each latent construct to establish and validate measurement models. Second, the internal consistency of the measurement instruments was discussed in this topic by conducting Cronbach's alpha scores. Lastly, validated measurement models were tested with control variables to identify the organizational and demographic variables that account for the variation in study construct.

After validating the measurement models, a generic structural equation model was established by aggregating the validated exogenous, endogenous, and control variables. The generic model was revised based on critical ratios and modification indices. Lastly, the hypotheses were assessed based on the results generated by structural equation modeling.

4.1 Descriptive Statistics

This study was conducted in the Turkish National Police (TNP) Aviation Department and its subunits, which employs a relatively limited number of employees. A web-based survey was conducted via www.surveymonkey.com. The survey questionnaire was distributed to a majority of the TNP Aviation Department employees, which numbered 297 in all. Fourteen subjects were either on temporary assignments or excused for medical or personal reasons. The survey questionnaire was thus conveyed to 283 subjects through e-mails, phone calls, or manually via assigned personnel in each city. It was important to reach most of the personnel working in the six cities because city and group differences were important to assess. Of the 283 subjects reached, 225 personnel participated in the survey, which represented a 79.5% response rate. A considerably higher response rate was achieved by using several strategies, including acquiring the top-level management's permission and support, assigning fellow personnel in six cities to ensure the highest participation rate, and informing employees about this research through the flight safety meetings held once a month in every unit of the TNP Aviation Department.

Fifteen respondents were eliminated because of missing responses exceeding 30% of survey questions. There remained 210 subjects with limited missing responses, which were handled by the data imputation method. Missing variables were replaced by the series mean because most of the variables were ordinal measurement level. Data imputation permitted the use of the 210 samples without losing any cases.

4.1.1 Control Variables

Control variables were the demographic and organizational characteristics of the subjects postulated as influencing the study variables. Task group, city, rank, age, educational level, years of service, and flight hours were considered to have effects on the safety climate perceptions and safety behaviors of organizational members. Table 3 indicates the descriptive statistics of control variables including frequency and percentage distributions.

Table 3. Frequency and Percentage Distributions for the Control Variables

Variable	#	Attributes	Frequency	Percent	Cumulative %
Group	1	Staff	84	40	40
In which group are you	2	Maintenance	60	28.6	58.6
working?	3	Pilot	66	31.4	100
City	1	Antalya	15	7.1	7.1
In which city are you	2	Adana	25	11.9	19
working?	3	Izmir	25	11.9	30.9
	4	Diyarbakir	44	21	51.9
	5	Istanbul	53	25.2	77.1
	6	Ankara	48	22.9	100
Rank	1	Police Officer	126	60	60
What is your rank?	2	Sergeant	33	15.7	75.7
	3	Captain	27	12.9	88.6
	4	Major	24	11.4	100
Age	1	Up to 30	28	13.3	13.3
What is your age?	2	Between 30 and 40	109	51.9	65.2
	3	More than 40	73	34.7	100
Education	1	High School	19	9	9
What is the highest	2	College	75	35.7	44.8
degree you completed?	3	University	86	41	85.7
	4	Master and above	30	14.3	100
Years of Service	1	Less than 5 years	52	24.8	24.8
How long have you	2	Between 5 and 10	58	27.6	52.4
been in the TNP	3	Between 10 and 15	61	29	81.4
Aviation Department?	4	More than 15 years	39	18.6	100
Flight Hours	0	No flight	84	40	40
What are your total	1	Less than 500	15	7.1	47.1
flight hours?	2	500 to 1000	25	11.9	59
	3	1000 to 1500	30	14.3	73.3
	4	1500 to 2500	41	19.5	92.9
	5	More than 2500	15	7.1	100

The survey was delivered to three groups of employees including pilots, maintenance personnel, and office staff. Pilots are the employees principally responsible for the aircraft and the mission performed. Of the 210 respondents, 66 respondents were pilots, accounting for 31.4% of all respondents. Maintenance personnel, the other main personnel in aviation organizations, have special training in aircrafts' technical aspects and perform at the operation line. Standard overhaul and troubleshooting tasks are performed via collaboration with pilots. Sixty maintenance personnel participated in the survey, which represents 28.6% of the total number of respondents. Office staff, the third group, consists of personnel dealing with air traffic control, petrol tanker and transportation vehicle driving, hangar and administrative building guarding, and clerical services. Of the 210 respondents, 84 respondents were office staff, representing 40% of all respondents. This group of respondents does not work in the operation line; however, their safety performance influences the overall safety of the organization. The task group variable was operationalized as the ordinal variable based on their closeness to the operation line and association with flight safety. Office staff respondents were assigned to 1 because these are subordinate personnel in terms of flight safety. Maintenance personnel respondents were assigned to 2 and pilot respondents were assigned to 3, because these are the principal personnel when flight safety is in question.

The survey was conducted in six cities, including the three biggest cities of Turkey—Ankara, Istanbul, and Diyarbakir—and regional leader cities—Adana, Izmir, and Antalya. These cities were ordered based on organization size and number of employees. Ankara has the biggest organization size and employee count because the top management and headquarters of the organization are located in this, the capital city of Turkey. Istanbul is the most crowded city in

Turkey, coming in after Ankara according to organizational size and number of employees. Diyarbakir is the biggest city in the southern area of the country, with the third biggest organizational size. Adana, Izmir, and Antalya are the biggest cities of their regions, containing relatively smaller size units with respect to the first three cities. The assigned values of these cities reflect their organization sizes. Hence, the city variable was operationalized as having an ordinal measurement level because the values simultaneously reflect the size of the units. Of the respondents, 48 were from Ankara, representing 22.9% of all respondents. Istanbul has the most active Police Aviation Unit participating in the survey, with 53 respondents representing 25.2% of all respondents. The number of respondents working in Diyarbakir was 44, accounting for 21% of all respondents. A relatively small numbers of respondents were from Adana, which had 25 respondents (11.9%), while Izmir had 25 respondents (11.9%) and Antalya had 15 respondents (7.1%).

Most of the pilots are selected from ranked officers and trained by the TNP Aviation Department. Maintenance personnel are selected from police officers, but they have the opportunity to take the ranked personnel exams after maintenance training. Hence, most of the pilots but few maintenance personnel are ranked officers. Office staff consists primarily of non-ranked police officers and a few ranked officers that organize the office work. Of the 210 respondents, 126 respondents were non-ranked police officers, accounting for 60% of the total respondents. Of the respondents having rank, 33 sergeants (15.7%), 27 captains (12.9%), and 24 majors (11.4%) participated in the study.

Regarding the age variable, TNP has a personnel policy that considers attrition time. TNP members must retire when police officers are 55 years old and ranked officers are 57 years old. Second, pilots, maintenance personnel, and air traffic controllers must provide medical reports for their health status to ensure their ability to continue their aviation duties. Personnel not having a qualified health status cannot work in the Aviation Department. Of the respondents, 28 respondents (13.3%) were less than 30 years old, 109 respondents were between the ages of 30 and 40 (51.9%), and 73 respondents were the ages of 40 and above (34.7%).

The TNP use two different methods to recruit personnel: one for ranked police officers and one for non-ranked officers. The first difference occurs in general recruiting, as most of the ranked police officers are selected from police colleges and high schools and receive subsequent training at the Police Academy, where they are awarded a bachelor's degree. The TNP also has two-year police technical colleges to recruit and train non-ranked police officers. All TNP members have at least a two-year college education, while all ranked officers have a minimum qualification of a four-year bachelor's degree. However, some mature police officers have only high school degrees, as they were part of the existing force before the new recruiting policy was implemented in 2003. Second, TNP members have the opportunity to obtain higher-level educations while they work. Hence, police officers can obtain graduate-level degrees to increase their service capacity. Of the total respondents, 19 respondents were high school graduates, 75 respondents were associate-level college graduates, 86 respondents had obtained their bachelor's degree, and 30 respondents held a master's or PhD-level degree. The percentage distributions based on educational level were 9% high school graduates, 35.7% college graduates, 41% bachelor's graduates, and 14.3% master's and PhD graduates.

The years of service variable reflects how long the employee has been employed by the TNP Aviation Department. This variable was operationalized into four categories—less than 5 years, between 5 and 10 years, between 10 and 15 years, and more than 15 years—to refer the experience level of respondents. Of the 210 respondents, 52 respondents (24.8%) had less than 5 years of service, 58 respondents (27.6%) had between 5 and 10 years of service, 61 respondents (29%) had between 10 and 15 years of service, and 39 respondents (18.6%) had more than 15 years of service in the TNP Aviation Department.

"Flight hours" is the last control variable and refers to the number of hours for which pilots and maintenance personnel have flown an aircraft. Flight hours are formally recorded in each aviation unit, not only for employees but also for the aircraft, to ensure the reliability of personnel and aircraft on mission assignments, as well as to provide incentives to employees having higher performance. The flight hours variable is operationalized according to certain levels of formal regulations to indicate the flight experience of pilots and maintenance personnel. Office staffs do not fly, so they were coded with a "0." Of the 210 respondents, 84 respondents (40%) had no flight hours, which was equal to the number of office staff. Fifteen respondents (7.1%) had fewer than 500 flight hours, which also indicated recently recruited pilots and maintenance personnel. The threshold level for becoming a pilot is 500 hours. Twenty-five respondents (11.9%) had between 500 and 1,000 flight hours. Thirty respondents (14.3%) had between 1,000 and 1,500 flight hours; 1,000 flight hours is another threshold level, at which pilots are assigned critical missions. Forty-one respondents (19.5%) had between 1,500 and 2,000 flight hours. These pilots are considered experienced and are assigned to recruited pilot

training and suspended pilot refreshing programs. Fifteen respondents (7.1) had 2,000 or more flight hours; these include the most experienced pilots.

4.1.2 Exogenous Variable

The study analyzes the influence of safety culture on individuals' safety behavior. Safety culture is the exogenous variable, and self-reported safety behavior is the endogenous variable of the study. The safety culture of the TNP Aviation Department was measured by the safety climate concept, which has been regarded as the measurable facet of the safety culture (Zohar & Luria, 2005; Fogarty & Shaw, 2009). Safety climate was conceptualized by four latent constructs as a four-factor measurement model. The study measures the safety climate of an organization via individual attitude toward safety, group norms, workplace pressures, and management attitude toward safety. Each of these dimensions is measured as the individual, group, and organizational level variables of safety climate (Hall, 2006; Fogarty & Shaw, 2009). First, each latent construct was explored separately to understand the structure and distributional characteristics of the data. Frequency analysis and correlation matrixes were conducted for each latent construct to observe the association between indicators, and demographic and organizational variables, as well as to identify any multicollinearity problem. A threshold level of .70 for the correlation coefficient was assigned to avoid a multicollinearity threat.

4.1.2.1 Own Attitude toward Safety

The first dimension of safety climate is the individual's own attitude toward safety, indicating the individual's own value expectancy of safety (Baron, 2008; Fogarty & Shaw, 2009). Own attitude (Own) was measured by seven items including risk perception, importance of safety tool usage, commitment to safety, and attitude toward safety regulations, safety violations, and errors. Survey participants were asked to respond questions based on the five-point Likert scale ranging from "strongly disagree" to "strongly agree." The frequency analysis and percentage distributions of the seven items can be seen in Appendix C.

Based on the frequency analysis and percentage distributions of Own statements, except for the fourth statement, a majority of the respondents strongly agreed or agreed with all statements. Own4 statement inquires about the employee's level of commitment toward safety, as well as his reaction when his safety concerns are overlooked by his fellows and supervisors. The cumulative percentage of the respondents who either strongly agreed or agreed with this indicator was 20.5%. On the other hand, 39.5% of respondents stated that they either strongly disagreed or disagreed with the Own4 statement. The remaining 40% of respondents stated that they agreed somewhat.

Two different correlation matrices were generated through the descriptive analysis. Spearman rho and gamma tests were conducted to analyze the correlations. First, the correlations between latent indicators and control variables were presented to reveal the relationships between the indicators and control variables proposed, and the strength as well as the direction of the relationship, if any existed. The patterns of relationship and percentage distributions were

observed by the gamma coefficient. Second, correlation matrixes were conducted to observe the association among latent indicators for an initial check to identify any multicollinearity problem. The initial check to identify a multicollinearity problem was conducted using the Spearman rho correlation test (see Appendix D).

According to the correlation matrixes, only two correlations between Own indicators and control variables had a significant relationships at the .05 level. The first significant correlation was between the Own3 indicator and the task group variable (r= -.227, p= .05). The Own3 indicator sought to assess an individual's reaction when his peers take shortcuts. A negative significant correlation showed that principals of flight missions (74.2% for pilots) agreed less often with the Own3 statement than did maintenance personnel (83.4%) and office staff (83.4%). The second significant correlation was between the Own4 indicator and the years of service variable (r= .202, p= .05). The Own4 indicator aimed to observe individuals' attitudes about reporting their peers' mistakes when their concerns are overlooked. A positive significant correlation reflected a systematic pattern that respondents' agreement that peers' mistakes should be reported increased as their service years increased. While reporting peers' mistakes was more acceptable for respondents having more than 15 years of service, the agreement declined as the respondent's years of service decreased.

For the initial check of the multicollinearity problem, the Spearman rho test was conducted. Most of the correlations between Own attitude indicators were significant at the 0.05 level, except for the correlations between Own2 and Own4, Own4 and Own6, and Own4 and Own7 indicators. The highest correlation was between the Own6 and Own7 indicators, with a

correlation value of 0.563, which was below the 0.70 criterion. These findings showed that Own attitude indicators did not have a multicollinearity problem.

4.1.2.2 Group Norms

Group norms is the second dimension of the organizational safety climate, indicating perceived social pressures in the workplace (Helmreich & Merritt, 2001; Hall, 2006) and generally acknowledged ways of performing particular tasks (Baron, 2008; Fogarty & Shaw, 2009). The group norms construct was measured by eight items including fellow workers' risk perception, safety devotion, and attitudes towards maintenance procedures, safety prioritization, and value expectancy of safety. The responses were scaled ranging from "strongly disagree" to "strongly agree."

A relatively high percentage of respondents indicated their agreement to most of the group indicators regardless of the organizational and demographic differences, except for the Group3 statement. The Group3 indicator aimed to observe the perceived support of fellows and their complementary level. The cumulative percentages were as follows: 21% of the respondents either strongly disagreed or disagreed, 30.5% of the respondents somewhat agreed, and 48.6% of the respondents either strongly agreed or agreed with the statement.

Correlation matrixes indicated eight significant correlations between Group indicators and control variables at the 0.05 level. The first correlation was observed between the Group2 indicator and the city variable (r=.375, p=.01). The Group2 indicator aimed to observe perceived group pressure to disregard safety regulations. The positive and significant correlation between

the Group2 and city variables reflects that respondents working in bigger organizations are more likely to perceive social pressure to disregard safety regulations than respondents working in smaller organizations.

Another significant correlation was observed between the Group4 and task group (r=.230, p=.05), city (r=-.267, p=.01), and rank (r=-317, p=.01) variables. The Group4 indicator was designed to assess co-workers' support of the organization's safety program; pilots (72.7%) are less likely to agree on co-workers' support than maintenance personnel (88.3%) and office staff (86.9%). The negative significant correlations showed that co-worker support decreases as organization size and respondent rank increase.

A correlation between the Group6 indicator and the city variable existed that was significant at the .01 level (r=-.281). The Group6 indicator was designed to observe the safety respect of co-workers. The negative significant correlation showed that co-workers' safety respect decreased as the size of the organization increased. The city variable also had a significant correlation with the Group7 indicator (r=-.158, p=.05). The Group7 indicator aimed to observe the safety reliability of the organization. The negative significant correlation reflected that safety reliability decreased as the size of the organization increased.

The Group8 indicator had a significant correlation with the task group (r=-.189, p=.05), and city (r=-.192, p=.05) variables. The Group8 indicator was designed to observe co-workers' safety priorities over time. The negative significant correlation showed that maintenance personnel (76.6%) and office staff (76.2%) were more likely to perceive co-workers' safety as a

priority than pilots (62.2%). The second correlation showed that the co-workers' safety priority increased as the size of organization decreased.

Correlations between Group indicators were significant except for correlations between Group1 and Group2, Group1 and Group3, Group2 and Group3, Group2 and Group8, Group3 and Group4, Group5, Group6, and Group7 based on the Spearman rho test. The highest correlation was between Group7 and Group8 indicators with a value of 0.470, which was below the 0.70 criterion. Therefore, the Group Norms indicators did not have a multicollinearity problem.

4.1.2.3 Management Attitude toward Safety

Management attitude toward safety was measured by nine questions including management's commitment, devotion, and support to safety, as well as management's attitude toward safety issues such as employee ideas and unsafe practices. The responses were scaled ranging from "strongly agree" to strongly disagree."

A majority of respondents reported their agreement to the statements except for the fourth, sixth and seventh indicators. The Management4 indicator aimed to observe the perceived management support when an employee reports his mistake. The cumulative percentages were as follows: 17.2% of the respondents either strongly disagreed or disagreed with management support, and 58.6% of the respondents either agreed or strongly agreed with it. The Management6 indicator observed the management's respect toward safety by asking whether the management discusses safety issues with employees. The cumulative percentages were as follows: 17.2% of the respondents either disagreed or strongly disagreed with the statement, and

60.4% of respondents either agreed or strongly agreed with it. The Management7 indicator asked about employees' perceptions of the management's safety priorities over time. The cumulative percentages were as follows: 15.7% of the respondents either agreed or strongly agreed with the statement, and 58.5% of the respondents either disagreed or strongly disagreed with it.

Correlation matrixes showed ten significant correlations between management indicators and control variables. The Management1 indicator had a significant correlation with the city variable (r=-0.179, p=0.05). The Management1 indicator was designed to observe perceived management support. The negative significant correlation showed that perceived management support perceived decreased as the size of organization increased. The city variable had a significant correlation with the Management2 indicator, which aimed to observe the management safety training provision (r= -0.183, p= 0.05). Respondents reported that management safety training provision increased as the size of the organization decreased.

Management3 was designed to observe management's attitude toward reporting safety-related incidents. The city variable had a significant correlation with the Management3 indicator (r= -0.242, p= 0.01), showing that respondents working in smaller organizations were more likely to perceive management as encouraging the reporting of safety-related incidents than respondents working in bigger organizations. The city variable had a significant correlation with the Management4 indicator, which aimed to observe the perceived management support when employees report their mistakes (r= -0.209, p= 0.01). Respondents working in smaller organizations are more likely to perceive management support than respondents working in bigger organizations. The city variable had a significant correlation with the Management5

indicator (r= -0.213, p= 0.01), which aimed to observe management’s leadership in keeping employees focused on safety. The negative significant correlation showed that management’s perceived leadership increased as the size of organization decreased. The years of service variable had a significant correlation with the Management6 indicator (r= -0.167, p= 0.05), which aimed to observe management’s respect toward safety. Respondents reported that management’s respect toward safety decreased as the respondents’ service year increased.

The management8 indicator was designed to observe supervisors’ attitudes toward employees’ ideas about improving safety. Management8 had a significant correlation with the task group (r= 0.301, p= 0.01), rank (r= 0.324, p= 0.01), age (r= -0.199, p= 0.05), and education (r= 0.234, p= 0.01) variables. Pilots (83.3%) were more likely to perceive supervisors’ respect for employees’ ideas than were maintenance personnel (66.7%) or office staff (57.2%). Second, supervisors’ respect toward ideas that improved safety increased as the rank of the respondents increased. Third, younger respondents (89.2%) were more likely to perceive supervisors’ respect than older respondents (67% for between 31-39 years old, 61.6% for more than 40 years old). Lastly, supervisors’ perceived respect increased as the respondents’ education level increased. The systematic pattern between supervisors’ perceived respect and task group, rank, age, and education attributes was noticeable.

An initial check for the multicollinearity problem was made via the Spearman rho test. Most of the correlations between the management indicators were significant, except for correlations between Management9, which was a reversed item, and other management indicators. The highest correlation was between Management1 and Management5 indicators with

a value of 0.535, which was below the 0.70 criterion. These values showed that management indicators did not have a multicollinearity problem.

4.1.2.4 Workplace Pressures

The ease or difficulty of working with safety procedures is called *workplace pressures*, which emerges as a formation of employees' experiences and anticipated obstacles (Hall, 2006). Workplace pressures arise from the lack of safety instrument provision and difficulty in working with the safety procedures directed by the organization. This construct aimed to observe the pressures arising from lack of time, personnel, and equipment; performance pressures exerted by the organization; and customer, peer, and self-induced pressure (Baron, 2008). Workplace pressures was measured by seven dimensions including time, workload, performance and task pressure, difficulty of use of safety regulations, individual's competence in safety, and accessibility of safety instruments.

Contrary to the first three constructs, workplace pressures indicators showed mostly disagreement on the Pressure5 (67.1% disagreement, 12.4% agreement), and Pressure6 (57.1% disagreement, 14.2% agreement) statements. The remaining five indicators had relatively balanced responses, as follows: Pressure1 (51.9 disagreement, 28.1% agreement), Pressure2 (49.1% disagreement, 20.5% agreement), Pressure3 (41% disagreement, 37.1% agreement), Pressure4 (50% disagreement, 34.2% agreement) and Pressure7 (50% disagreement, 20.9% agreement).

The correlation matrixes of pressure indicators and control variables indicated thirteen significant correlations. The Pressure1 indicator had a significant relationship with task group (r= -.329, p= .01), rank (r= -.304, p= .01), and flight hours (r= -.237, p= .01). The Pressure1 indicator was designed to observe the pressure stemming from the need to complete tasks on time. For the task group variable, office staff (45.2%) more often agreed or strongly agreed about the existence of pressure stemming from the need to complete tasks on time than did maintenance personnel (20%) and pilots (13.6%). For the rank variable, this kind of pressure increased as the respondents' rank decreased. Lastly, the pressure perceived decreased as the respondent's flight hours increased.

The flight hours variable had a significant correlation with the Pressure2 indicator (r= - .146, p= .05), which was designed to observe time pressures. Respondents reported that time pressures over safety increased as the respondent's flight hours decreased. Pressure3 was designed to observe workload pressure over safety. Pressure3 had a significant correlation with the task group (r= -.177, p= .05) and age (r= .186, p= .05) variables. Office staff (40.5%) more often agreed or strongly agreed with the statement than maintenance personnel (40%) and pilots (30.3%). For the age variable, workload pressure over safety increased as the respondents grew older.

Pressure5 had a significant correlation with the task group (r= -.235, p= .01), city (r= .185, p= .05), rank (r= -.220, p= .01), age (r= .243, p= .01), and education (r= -.174, p= 0.05) variables. Pressure5 aimed to observe workload pressure effects emerging as shortcuts and risk-taking behaviors. The negative significant correlation showed that office staff (21.4%) more

often agreed or strongly agreed to the statement than maintenance personnel (10%) and pilots (3%). As the size of organization increased, the perceived prevalence of shortcuts and risk-taking behaviors increased. The respondents reported that lower ranks were more likely to agree with this statement than higher ranks. Older respondents were more likely to agree with the statement than were younger respondents. Lastly, as the education of the respondents increased, the prevalence of shortcuts and risk-taking behaviors due to a heavy workload decreased.

Pressure6 was designed to observe the pressure stemming from an individual's own safety competence. This indicator had a significant correlation with the task group ($r= -.199$, $p= .05$) and city ($r= .258$, $p= .01$) variables. The negative significant correlation reflects that office staff (20.2%) more often agreed or strongly agreed with the statement than maintenance personnel (10%) and pilots (10.6%). Second, the pressure stemming from safety competence increased as the size of organization increased.

For the initial check of the multicollinearity problem, the Spearman rho test was conducted on workplace pressure indicators. Except for the correlations between the Pressure1 and Pressure6, and Pressure 3 and Pressure6 indicators, most of the correlations were significant at the .05 level. The highest correlation was between Pressure4 and Pressure7 indicators with a value of .538, which was below the 0.70 criterion. It can be assumed that the workplace pressure indicators did not have a multicollinearity problem.

4.1.3 Endogenous Variables

Self-reported safety behavior is the endogenous variable of the study. Safety behavior was conceptualized as a two-factor measurement model including violation and error items. Safety behavior was classified into two categories by Wiegmann & Shappell (2001; 2003) in the human factors analysis and classification system. The first category is violation, which refers to willfully and consciously disregarding approved safety regulations and procedures. The second category of unsafe behavior is error, which refers to an individual's activities accidentally failing to accomplish an intended outcome (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; 2003).

Intention was included in the study model to strengthen the relation between the exogenous variable and endogenous variables (Ajzen, 1991; Fogarty & Shaw, 2009). A descriptive analysis of the intention, and then of the violation and error variables, is presented in the next sections.

4.1.3.1 Intention toward Safety Behavior

Intention is the motivational factor influencing an individual's behavior. Intention determines how much effort an individual plans to expend in order to achieve a particular behavior (Ajzen, 1991). The intention construct was measured by six items including safety commitment, pre-checking, manipulation, risk taking, and viewpoint items. The responses were scaled based on a five-point Likert scale ranging from "strongly agree" to "strongly disagree."

Except for the fourth indicator, the majority of respondents either agreed or strongly agreed with the statements. The Intention4 indicator was designed to observe individuals' commitments to approved procedures and processes. The cumulative percentage of the respondents who either agreed or strongly agreed with Indicator4 was 36.2%. On the other hand, 38.1% of respondents either disagreed or strongly disagreed with the statement.

Thirteen significant correlations were found between the intention indicators and the control variables. The Intention1 indicator had a significant correlation with the city variable (r= -.235, p= .01). The Intention1 indicator was designed to observe an individual's intention to thoroughly check safety procedures before starting to work. An individual's intention to check safety procedures increased as the size of organization decreased. The city variable had a significant correlation with the Intention2 indicator (r= -.256, p= .01). Intention2 aimed to observe the individual's intention to check additional safety measures, which increased as the size of the organization decreased.

The Intention4 indicator had significant correlations with the task group (r= .386, p= .01), rank (r= .291, p= .01), education (r= .202, p= .01), years of service (r= .219, p= .01), and flight hours (r= .305, p= .01) variables. Intention4 aimed to observe an individual's intention to manipulate approved safety procedures, which increased as the rank, education, years of service, and flight hours of the respondents increased, because all variables were positively correlated. Likewise, pilots (53%) more often agreed or strongly agreed with the statement than maintenance personnel (38.4%) and office staff (21.5%).

The city (r= -.207, p= .01) and flight hour (r= .157, p= .05) variables had significant correlations with the Intention5 indicator, which aimed to observe individuals' intentions to take risks. The significant negative correlation between the city variable and the Intention5 indicator showed that an individual's intention to take risks decreased as the size of the organization increased. On the other hand, individuals' intentions to take risks increased as their flight hours increased. Intention6, the last indicator of the intention construct, observed individuals' viewpoints on approved safety regulations. Intention6 had a significant correlation with the task group (r= -.238, p= .01), city (r= -.314, p= .01), rank (r= -.248, p= .01), and education (r= -.199, p= .05) variables. Maintenance personnel (86.6%) more often agreed or strongly agreed with the Intention6 statement than office staff (78.5%) and pilots (77.6%). The negative significant correlation reflects that individuals' commitment to safety regulations decreased as the size of the organization and the rank and education of the respondents increased.

For the multicollinearity problem, the Spearman rho test was conducted to check the high correlations. Most of the correlations of the intention indicators were significant except for the correlations between the Intention1 and Intention4, Intention3 and Intention4, and Intention4 and Intention6 indicators. The highest correlation was between Intention2 and Intention5 with a coefficient value of .476, which was below of the 0.70 criterion. These findings showed that the intention indicators did not have a multicollinearity problem.

4.1.3.2 Violation Behavior

The endogenous variable of the study was self-reported safety behavior. Violation was the first factor of the two-factor model, and referred to willful disregard for formal safety regulations and procedures. Violations were classified in two groups: routine violations and exceptional violations (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003). Self-reported violation behavior was measured by five indicators, which included bending safety regulations, breaking responsibilities, and violating approved documentation procedures. Statements were responded to with a five-point Likert scale.

More than half of the respondents disagreed or strongly disagreed with the first two indicators (60% for Violation1, 51% for Violation2). Four significant correlations were observed between the violation indicators and the control variables. Violation2 had a significant correlation with the city variable (r= .211, p= .01). Violation2 aimed to observe violating approved documentation procedures when performing a familiar task; this type of violation increased as the size of the organization increased. The Violation4 indicator had a significant correlation with the city (r= .155, p= .05), and years of service (r= .253, p= .01) variables. Violation4 was designed to observe the extent to which individuals violated part of their job's requirements to make a job easier. Violating part of a job increased as the size of the organization and individuals' service years increased. The last correlation was between the years of service variable and the Violation5 indicator (r= .144, p= .05), which aimed to observe an individuals' confidence in their responsibilities for job safety. As individuals' years of service increased, individuals' confidence in their job safety responsibilities increased.

Most of the correlations between violation indicators were significant at the .01 level. The highest correlation was between Violation4 and Violation5 indicators with a coefficient value of .520, which was below the .70 criterion. This means violation indicators did not have a multicollinearity problem.

4.1.3.3 Error Behavior

The second factor of safety behavior was the error construct, which referred to individuals' activities accidentally failing to achieve intended outcomes (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003). Self-reported error behavior was measured by four items, including decision-, skill-based, and perceptual errors.

The majority of the respondents disagreed or strongly disagreed with the error items. The Error1 indicator had a significant correlation with the city (r= .335, p= .01), age (r= .224, p= .05), years of service (r= .317, p= .01), and flight hour (r= .196, p= .05) variables. The Error1 indicator aimed to observe decision errors, which arise from improper choices and poorly executed procedures (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003). Positive significant correlations showed that decision errors increased as the size of the organization and the age, years of service, and flight hours of the individual increased.

The Error2 indicator was designed to observe skill-based error arising from attention and/or memory failures (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003). The Error2 indicator had a significant correlation with the city variable (r= .327, p= .01). Skill-based errors increased as the size of the organization increased.

The Error3 and Error4 indicators were designed to observe perceptual errors arising from imperfect or inadequate information, misjudgments, and responding incorrectly to a diverse of visual and vestibular illusions (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003). Error3 had a significant correlation with the city (r= .207, p= .05), age (r= .203, p= .05), and education (r= -.181, p= .05) variables. The positive significant correlation showed that perceptual errors increased as the size of the organization and the respondent's age increased. The negative significant correlation showed that skill-based errors decreased as the education level of the respondent increased. The Error4 indicator had a significant correlation with the city (r= .164, p= .05) and age (r= .295, p= .01) variables. The positive significant correlation showed that skill-based errors increased as the size of the organization and respondent's age increased.

Most of the correlations between the error indicators were significant at the .01 level. The highest correlation was between the Error2 and Error4 indicators with a coefficient value of .458, which was below the .70 criterion. These findings showed that the error indicators did not have a multicollinearity problem.

4.2 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is an extension of factor analysis that evaluates the validity of the measurement models of latent constructs (Hox & Bechger, 1998; Byrne, 2010). Model validation refers to the degree to which the proposed measurement model measures what it is intended to measure (Trochim, 2001). The three-stage approach suggested by Wan (2002)

was preferred for the model validation process because it is the most clear and coherent method presented in the literature. First, theoretical measurement models were developed as generic models via presumed indicators. Specification of the measurement models is the starting point of structural equation modeling techniques (Hu & Bentler, 1999). In the generic measurement models, one indicator was selected as a scale factor in order to derive factor loading estimates for the other indicators. Given parameter estimates and standard errors, appropriate indicators were selected using correlations and squared multiple correlations (Wan, 2002). Second, the overall fit of the measurement model was evaluated based on the goodness-of-fit statistics. Estimation of parameters and the assessment of goodness of fit were the primary goals (Hu & Bentler, 1999). AMOS software version 18 produced goodness-of-fit statistics to assess whether the measurement model fit the data. Third, the model was evaluated to identify the reasons for lack of fit (Wan, 2002). The measurement errors of the indicators were correlated with each other based on the modification indices to improve the measurement models (Hox & Bechger, 1998; Wan, 2002; Schumacker & Lomax, 2004). The revised measurement model of each latent variable was presented with a figure and goodness-of-fit parameters table.

After the validation of the measurement models, the internal consistency of the measurement instruments was tested by obtaining Cronbach’s alpha scores. SPSS version 16 produced a Cronbach’s alpha score for each latent variable. As a general rule, a score of .70 and above was regarded as reliable (Bland & Altman, 1997). Lastly, the validated measurement models were tested with control variables to identify the effects of organizational and demographic attributes on the variation of the study constructs.

4.2.1 Exogenous Variable

Safety climate was used as a measurement model along with four correlated theoretical constructs including own attitude, group norms, management attitude, and workplace pressures. First, four major components of the exogenous variable were validated separately. The validated components of safety climate were integrated as a four-factor measurement model and validated using confirmatory factor analysis (Wan, 2002).

4.2.1.1 Own Attitude toward Safety

The first major component of the exogenous variable is own attitude toward safety, which was measured by seven indicators. Using a five-point Likert scale, respondents were asked to state their agreement or disagreement with the statements. Seven indicators were included in the hypothesized measurement model, and confirmatory factor analysis was conducted to validate the measurement of the Own Attitude latent construct. A three-stage approach was followed step by step, as suggested by Wan (2002).

The first stage of confirmatory factor analysis is to identify appropriate indicators that have statistically significant values based on their critical ratios and possess enough factor loadings. Critical ratio is used to specify the significance of the standardized regression weights. All the factor loadings of the own attitude indicators had critical ratios higher than 1.96, which indicated a statistically significant association at the .05 level. Factor loading (standardized regression weights) refers to the extent to which the indicator (the observed variable) is related to the latent construct (the unobserved variable) (Byrne, 2010). For this study, .50 was established

as a cutoff threshold for factor loadings. Indicators having factor loadings lower than .50 were excluded from the measurement models. For the own attitude measurement model, the Own4 indicator was excluded from the model because it had a factor loading value of .186. After removing the Own4 indicator, all remaining indicators had strong factor loadings ranging from .584 to .755.

The second stage for the own attitude measurement model was the evaluation of overall fit—how well the measurement model fit the data. Evaluation of the own attitude measurement model showed that the model fit was still not within acceptable limits, despite having significant and high factor loadings. The measurement model of six indicators needed to be modified to improve the model fit. An assessment of adequate model fit means that the difference between the sample covariance matrix and the model-implied covariance matrix is small enough (Wan, 2002; Schumacker & Lomax, 2004). The similarity of the matrixes is interpreted as the data's fit to the theoretical model. The third stage of the model validation process is thus launched: identifying the possible reasons for lack of fit.

In the third stage, freeing parameters based on their modification indices was used. The modification index of a particular parameter refers to the fact that when this parameter is allowed to be free, the value of the chi-square decreases by at least the value of the index (Wan, 2002; Schumacker & Lomax, 2004). The AMOS program reports modification indices for all non-free parameters. The structural paths were inserted based on the modification indices to further improve model fit. At each step, one pair of error terms having the largest improvement in the

model was correlated. This process was repeated until the model showed a reasonably good model fit. Figure 4 shows the revised measurement model of the own attitude construct.

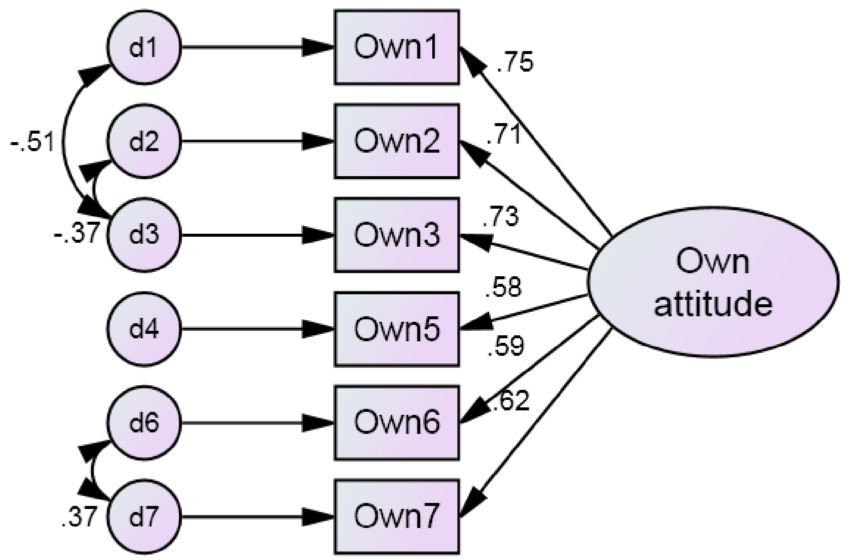

Figure 4. Revised Measurement Model for Own Attitude

Figure 4 shows the revised measurement model for the own attitude construct, which consists of six indicators. The factor loadings have values ranging from .58 to .75. Three pairs of errors were correlated based on the modification indices to improve the model fit. All regression coefficients were significant at the .05 level. Table 4 indicates parameter estimates for the generic and revised own attitude measurement models.

Table 4. Parameter Estimates for the Own Attitude Measurement Models

Indicator			**Generic Model**					**Revised Model**				
			URW	**SRW**	**SE**	**CR**	**P**	**URW**	**SRW**	**SE**	**CR**	**P**
Own1	<-	Own	1.038	.685	.121	8.601	***	1.321	.755	.169	7.806	***
Own2	<-	Own	.838	.660	.101	8.329	***	1.044	.712	.137	7.632	***
Own3	<-	Own	.768	.593	.102	7.555	***	1.092	.727	.167	6.555	***
Own4	<-	Own	.278	.186	.114	2.442	.015					
Own5	<-	Own	.871	.580	.118	7.408	***	1.014	.584	.139	7.307	***
Own6	<-	Own	1.032	.694	.119	8.701	***	1.014	.591	.109	9.310	***
Own7	<-	Own	1	.717				1	.620			

Several parameters have been used in the SEM literature for assessing model fitness. There is no consensus as to which fit indices to report. However, it has been recommended to avoid reporting all of them, while using at least three fit tests from different categories has been recommended (Garson, 2009). Determination of fit indexes and the rules of thumb for cutoff criteria have been the most pressing issues for many researchers (Hu & Bentler, 1999). The goodness-of-fit indices and index criteria were selected based on Garson's (2009) recommendations. The selection of goodness-of-fit tests was discussed in the methodology chapter. Chi-square goodness-of-fit statistics, Hoelter's critical N, the Root Mean Square Error of Approximation (RMSEA), the Tucker Lewis Index (TLI), and the Comparative Fit Index (CFI) were selected to test model fit. Given the selected goodness-of-fit tests, the generic and revised measurement models' parameters are documented in Table 5.

Table 5. Goodness-of-Fit Statistics for Own Attitude

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	Low	51.616	4.239
Degrees Of Freedom (df)	≥ 0	14	6
Likelihood Ratio (x^2/df)	< 4.0	3.687	0.707
P value	≥ 0.05	0	0.644
Tucker Lewis Index (TLI)	> 0.90	0.855	1.012
Comparative Fit Index (CFI)	> 0.90	0.903	1
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.113	0
Probability (p-close)	≥ 0.05	0.001	0.852
Hoelter's Critical N (CN)	> 200	96	621

As seen in Table 5, model fit substantially improved in the final model compared with the generic model. The difference between the generic and revised models (Δx^2) is computed at 47.377, which indicates a significant improvement of model fit in the revised model. Most of the goodness-of-fit statistics indicate a reasonably good fit of the measurement model to the data. The critical ratios for the standardized regression weights demonstrated significant relationships, and all correlations were significant at the .05 level for all observed variables. All indicators loaded strongly on the factor, ranging from .58 to .75. Confirmatory factor analysis validated that the revised measurement model measures the own attitude construct, and that the model fits to the data.

After the validation of the own attitude measurement model, the internal consistency of the instrument was tested by obtaining Cronbach's alpha scores. The Cronbach's alpha score of

own attitude measurement instrument was determined to be above the recommended level with a score of .817, indicating a satisfactory reliability level.

4.2.1.2 Group Norms

The second component of the exogenous variable is group norms, measured by eight indicators. The generic measurement model was established with eight indicators, and confirmatory factor analysis was conducted to validate the group norms measurement model. All the factor loadings had critical ratios higher than 1.96, except for the Group3 indicator, which was excluded from the model. The Group2 and Group6 indicators were excluded from the measurement model because they had factor loadings lower than .50. The remaining five indicators had significant regression weights and adequate factor loadings ranging from .546 to .858 at the .05 level.

Evaluation of the overall fit showed that the model fit was still not within acceptable limits. The measurement model of five indicators needed to be modified to improve the model fit. Hence, structural paths were inserted based on the modification indices. Correlating one pair of error terms (Group5 and Group8) rendered a model with a reasonably good model fit. Figure 5 shows the revised measurement model of the group norms construct.

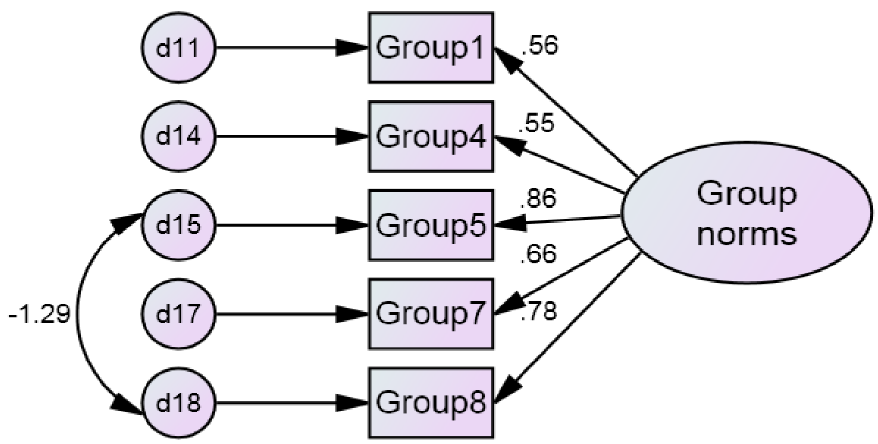

Figure 5. Revised Measurement Model for Group Norms

As seen in Figure 5, the factor loadings have values ranging from .56 to .86. One error pair was correlated based on the modification index. All critical ratios were statistically significant at the .05 level. Table 6 indicates the parameter estimates for the generic and revised group norms measurement models.

Table 6. Parameter Estimates for the Group Norms Measurement Models

			Generic Model					Revised Model				
Indicator			**URW**	**SRW**	**SE**	**CR**	**P**	**URW**	**SRW**	**SE**	**CR**	**P**
Group1	<-	Group	.828	.576	.124	6.662	***	.633	.558	.090	7.005	***
Group2	<-	Group	.338	.242	.109	3.092	.002					
Group3	<-	Group	.243	.132	.142	1.711	.087					
Group4	<-	Group	.837	.581	.125	6.705	***	.621	.546	.090	6.897	***
Group5	<-	Group	1.003	.698	.131	7.648	***	.973	.858	.126	7.691	***
Group6	<-	Group	.768	.577	.115	6.67	***					
Group7	<-	Group	1.374	.748	.173	7.962	***	.959	.662	.121	7.902	***
Group8	<-	Group	1	.619				1	.785			

The goodness-of fit statistics for the group norms measurement model substantially improved in the revised model compared with the generic model. The goodness-of-fit statistics of the generic and revised measurement models are documented in Table 7.

Table 7. Goodness-of-Fit Statistics for Group Norms

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	Low	79.472	4.39
Degrees Of Freedom (df)	≥ 0	20	4
Likelihood Ratio (x^2/df)	< 4.0	3.974	1.098
P value	≥ 0.05	0	0.356
Tucker Lewis Index (TLI)	> 0.90	0.782	0.997
Comparative Fit Index (CFI)	> 0.90	0.844	0.999
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.119	0.022
Probability (p-close)	≥ 0.05	0	0.595
Hoelter's Critical N (CN)	> 200	22	452

Table 7 indicates the goodness-of-fit statistics of the generic and revised measurement models of the group norms construct. The difference between the generic and revised model (Δx^2) was calculated at 75.082, indicating significant improvement of model fit in the revised model. Most of the goodness-of-fit statistics and indices were within recommended limits. Therefore, the revised measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the latent construct of group norms.

To assess the internal consistency of the measurement instrument, the Cronbach's alpha score was generated by the SPSS software. The group norms measurement instrument had a Cronbach's alpha score of .782, which was greater than the recommended .70 level. The

reliability of the group norms measurement instrument was satisfactory based on the reliability test.

4.2.1.3 Management Attitude toward Safety

Management attitude is the third component of safety climate. Nine indicators were designed to measure the management attitude construct. The generic measurement model was established with nine indicators and validated by confirmatory factor analysis. Most of the factor loadings had critical ratios greater than 1.96, except for the Management9 indicator. After excluding Management9, the indicators having low factor loadings were identified. Management6 and Management8 were excluded from the measurement model they made a lesser contribution to the measurement of the group norms. The remaining six indicators had significant regression weights and adequate factor loadings ranging from .569 to .823 at the .05 level.

Evaluation of the overall fit showed that the model fit was still not within acceptable limits. The measurement model of five indicators needed to be modified to improve the model fit. Hence, structural paths were inserted based on the modification indices. Correlating one pair of error terms (Management3 and Management5) ensured that the measurement model had a reasonably good model fit. Figure 6 shows the revised measurement model of the management attitude construct.

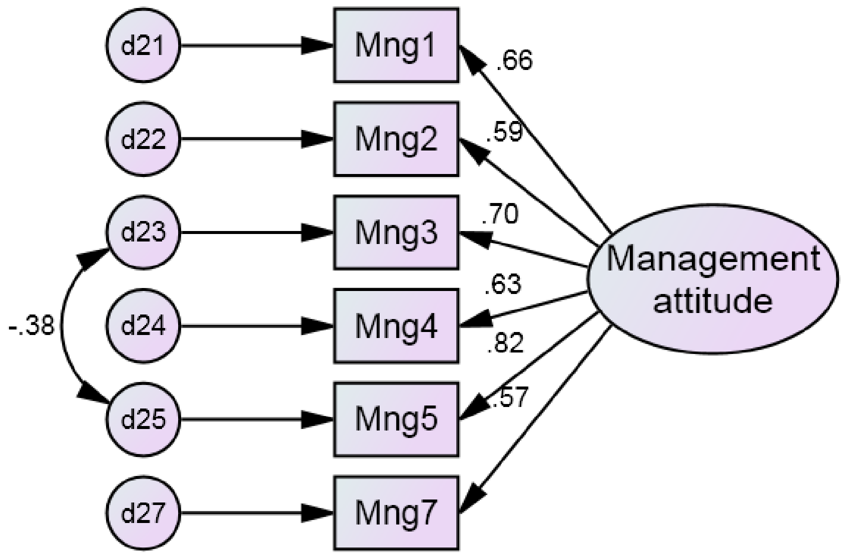

Figure 6. Revised Measurement Model for Management Attitude

The revised measurement model for management attitude had six indicators, with factor loadings ranging from .569 to .823. All regression coefficients and covariance between error terms were significant at the .05 level. Table 8 indicates the parameter estimates for the generic and revised management attitude measurement models.

Table 8. Parameter Estimates for the Management Attitude Measurement Models

			Generic Model					**Revised Model**				
Indicator			**URW**	**SRW**	**SE**	**CR**	**P**	**URW**	**SRW**	**SE**	**CR**	**P**
Mng1	<-	Management	1.000	.667				.917	.657	.126	7.261	***
Mng2	<-	Management	.991	.593	.134	7.378	***	.917	.589	.136	6.738	***
Mng3	<-	Management	.985	.637	.126	7.846	***	1.010	.701	.144	7.002	***
Mng4	<-	Management	1.181	.636	.151	7.839	***	1.081	.625	.154	7.024	***
Mng5	<-	Management	1.378	.757	.153	8.992	***	1.397	.823	.180	7.760	***
Mng6	<-	Management	.963	.509	.149	6.443	***					
Mng7	<-	Management	1.193	.633	.153	7.8	***	1.000	.569			
Mng8	<-	Management	.879	.520	.134	6.571	***					
Mng9	<-	Management	-.099	-.064	.118	-.845	.398					

The management attitude measurement model substantially improved in the revised model compared with the generic model. Improvement of the model fit can be seen from the table. The goodness-of-fit statistics of the generic and revised measurement models are presented in Table 9.

Table 9. Goodness-of-Fit Statistics for Management Attitude

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	Low	37.69	5.97
Degrees Of Freedom (df)	≥ 0	27	8
Likelihood Ratio (x^2 /df)	< 4.0	1.396	0.746
P value	≥ 0.05	0.083	0.651
Tucker Lewis Index (TLI)	> 0.90	0.969	1.011
Comparative Fit Index (CFI)	> 0.90	0.977	1
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.044	0
Probability (p-close)	≥ 0.05	0.6	0.88
Hoelter's Critical N (CN)	> 200	223	543

The difference between the generic and revised model (Δ x^2) is calculated at 31.72, indicating significant improvement of model fit in the revised model. Most of the goodness-of-fit statistics and indices were within recommended limits. Therefore, the management attitude measurement model demonstrated an acceptable fit of the model to the data and was confirmed as a measurement model for the latent construct of group norms.

The Cronbach's alpha score was computed for the internal consistency of the management attitude measurement instrument. The Cronbach's alpha score for the measurement scale of management attitude was .814, which was greater than the recommended .70 level. The

reliability of the management attitude measurement instrument was satisfactory based on the reliability test.

4.2.1.4 Workplace Pressures

The workplace pressures measurement model contained seven items. According to the first stage of confirmatory factor analysis, all indicators had critical ratios higher than 1.96. The Pressure1 and Pressure6 indicators were excluded from the model because they had factor loading scores lower than .50. The remaining five indicators had significant regression weights and adequate factor loadings ranging from .535 to .823 at the .05 level.

Evaluation of overall fit showed that the measurement model of workplace pressures had a reasonably good model fit without any modification. Figure 7 shows the revised measurement model of the workplace pressures construct.

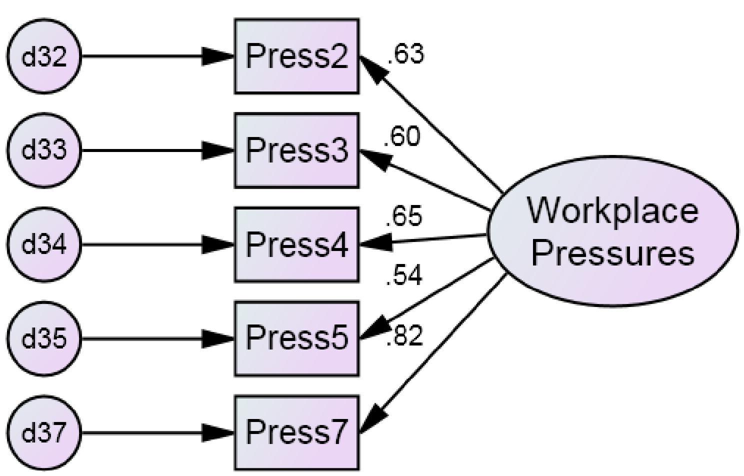

Figure 7. Revised Measurement Model for Workplace Pressures

Most of the factors had significant loadings ranging from .53 to .82. The model has an acceptable fit without modification. All critical ratios were statistically significant at the .05 level. Table 10 indicates parameter estimates for the generic and revised workplace pressures measurement models.

Table 10. Parameter Estimates for the Workplace Pressures Measurement Models

			Generic Model					Revised Model				
Indicator			**URW**	**SRW**	**SE**	**CR**	**P**	**URW**	**SRW**	**SE**	**CR**	**P**
Press1	<-	Pressure	.669	.452	.110	6.057	***					
Press2	<-	Pressure	.822	.652	.093	8.812	***	.791	.631	.095	8.303	***
Press3	<-	Pressure	.934	.596	.116	8.063	***	.930	.597	.118	7.884	***
Press4	<-	Pressure	1.080	.638	.125	8.63	***	1.101	.655	.128	8.587	***
Press5	<-	Pressure	.737	.547	.100	7.376	***	.716	.535	.101	7.072	***
Press6	<-	Pressure	.343	.272	.095	3.607	***					
Press7	<-	Pressure	1	.818				1	.823			

The workplace pressures measurement model substantially improved in the revised model compared with the generic model. The goodness-of-fit statistics for the generic and revised measurement models is documented in Table 11.

Table 11. Goodness-of-Fit Statistics for Workplace Pressures

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	Low	30.108	4.251
Degrees Of Freedom (df)	≥ 0	14	5
Likelihood Ratio (x^2/df)	< 4.0	2.151	0.85
P value	≥ 0.05	0.007	0.514
Tucker Lewis Index (TLI)	> 0.90	0.927	1.006
Comparative Fit Index (CFI)	> 0.90	0.951	1
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.074	0
Probability (p-close)	≥ 0.05	0.126	0.751
Hoelter's Critical N (CN)	> 200	165	545

The workplace pressures generic and revised measurement models' goodness-of-fit statistics had substantial differences. The improvement of the model was evaluated based on the chi-square difference. The difference between the generic and revised model ($\Delta\ x^2$) was calculated at 25.857, indicating significant improvement of model fit in the revised model. Most of the goodness-of-fit statistics and indices were within recommended limits. Therefore, the revised measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the latent construct of workplace pressures.

The Cronbach's alpha score was computed for the internal consistency of the workplace pressures measurement instrument. The Cronbach's alpha score for the measurement scale of workplace pressures was .774, which was greater than the recommended .70 level. The reliability of the workplace pressures measurement instrument was satisfactory based on the reliability test.

4.2.1.5 Safety Climate

The safety climate measurement model was established by four correlated constructs, including own attitude, group norms, management attitude, and workplace pressures. The same principals of confirmatory factor analysis were applied to validate the four-factor measurement model of safety climate construct. Safety climate is defined as a multi-dimensional construct (Ajzen, 1991; Fogarty & Shaw, 2009). The validated components of safety climate were aggregated in the one-measurement model and validated by confirmatory factor analysis.

For the four-factor measurement model of safety climate, all the factor loadings had critical ratios greater than 1.96. All the factor loadings were greater than .5, ranging from .54 to .82. However, evaluation of the overall fit showed that the model fit was still not within acceptable limits. The measurement model of five indicators needed to be modified to improve the model fit. Hence, structural paths were inserted based on the modification indices to improve the model fit. The correlating five pairs of error terms provided the model with a reasonably good fit to the data. Figure 8 indicates the revised measurement model of the safety climate construct.

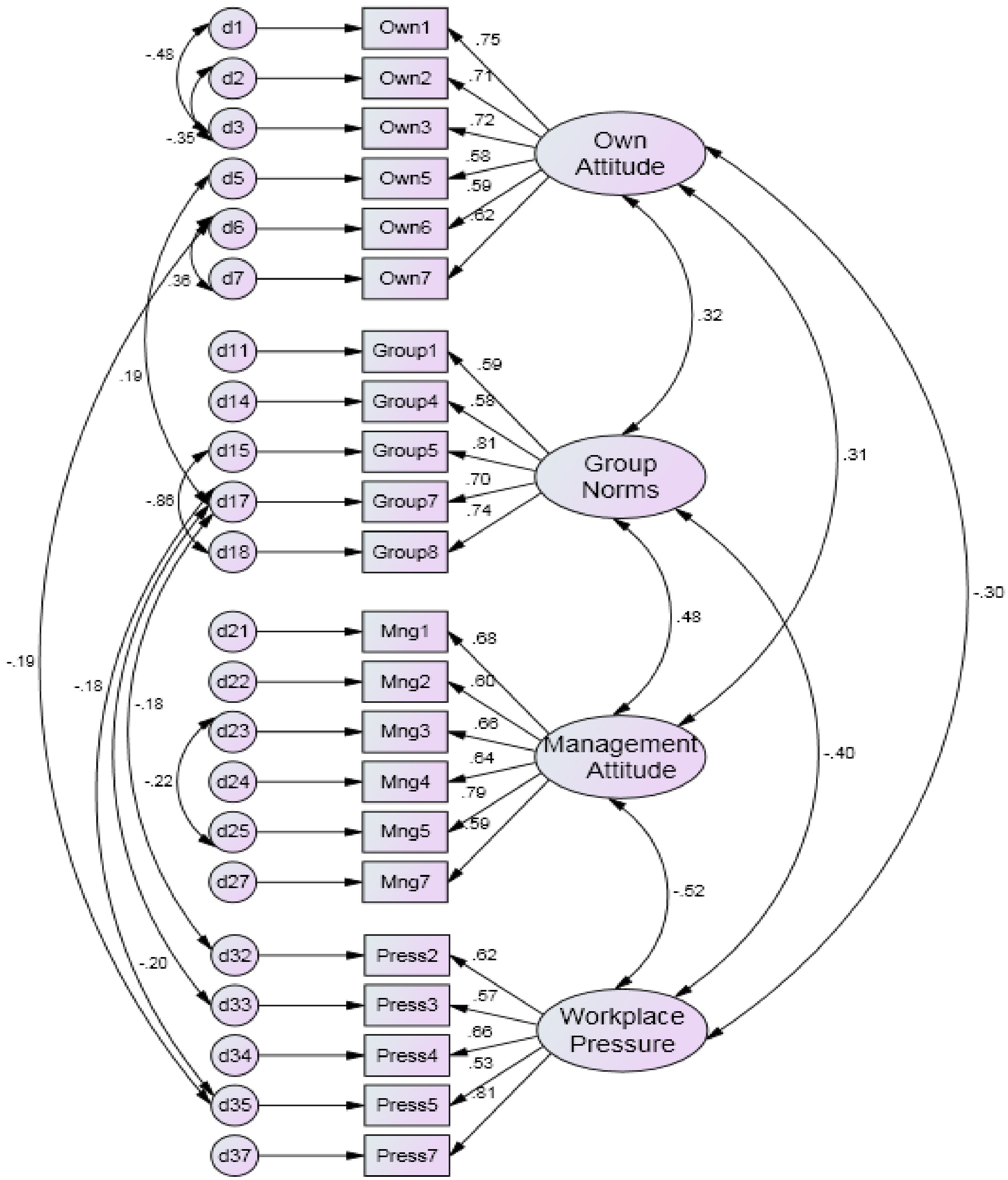

Figure 8. Revised Measurement Model for Safety Climate

As seen in the revised measurement model, all factor loadings were statistically significant, having values ranging from .53 to .81. All covariance values were significant at the .5 level. The estimated correlations between own attitude and workplace pressures were relatively low (r= -.30 for workplace pressures, r= .31 for management attitude, and r= .32 for group norms). On the other hand, group norms' correlations between management attitude (r= .48) and workplace pressures (r= -.40) were relatively high. The highest correlation was between workplace pressures and management attitude (r= -.52), at the .05 level. Table 12 indicates parameter estimates for the generic and revised safety climate measurement models.

Table 12. Parameter Estimates for the Safety Climate Measurement Models

			Generic Model					Revised Model				
Indicator			**URW**	**SRW**	**SE**	**CR**	**P**	**URW**	**SRW**	**SE**	**CR**	**P**
Own1	<-	Own	1.296	.750	.162	8.006	***	1.309	.752	.164	7.975	***
Own2	<-	Own	1.031	.711	.132	7.806	***	1.039	.712	.134	7.772	***
Own3	<-	Own	1.051	.710	.153	6.861	***	1.076	.721	.157	6.870	***
Own5	<-	Own	1.013	.591	.137	7.371	***	.992	.579	.136	7.317	***
Own6	<-	Own	1.010	.596	.108	9.319	***	.998	.589	.107	9.316	***
Own7	<-	Own	1.000	.628				1.000	.624			
Group1	<-	Group	1.000	.585				1.000	.587			
Group4	<-	Group	.990	.578	.138	7.154	***	.988	.579	.138	7.178	***
Group5	<-	Group	1.374	.804	.172	7.993	***	1.388	.814	.171	8.119	***
Group7	<-	Group	1.532	.701	.186	8.227	***	1.532	.700	.183	8.374	***
Group8	<-	Group	1.431	.746	.189	7.587	***	1.411	.737	.186	7.576	***
Mng1	<-	Management	1.000	.681				1.000	.681			
Mng2	<-	Management	.978	.597	.128	7.659	***	.977	.597	.128	7.653	***
Mng3	<-	Management	1.002	.661	.126	7.953	***	1.003	.662	.126	7.960	***
Mng4	<-	Management	1.164	.640	.143	8.155	***	1.166	.641	.143	8.166	***
Mng5	<-	Management	1.415	.793	.151	9.359	***	1.413	.792	.151	9.341	***
Mng7	<-	Management	1.089	.590	.144	7.576	***	1.089	.590	.144	7.571	***
Press2	<-	Press	1.000	.640				1.000	.620			
Press3	<-	Press	1.151	.593	.163	7.044	***	1.139	.569	.172	6.632	***
Press4	<-	Press	1.376	.656	.180	7.625	***	1.454	.662	.195	7.471	***
Press5	<-	Press	.902	.540	.138	6.53	***	.918	.528	.145	6.319	***
Press7	<-	Press	1.237	.816	.143	8.675	***	1.283	.808	.154	8.325	***

Goodness-of-fit statistics for generic and revised safety climate measurement models are documented in Table 13.

Table 13. Goodness-of-Fit Statistics for Safety Climate

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	Low	252.938	222.68
Degrees Of Freedom (df)	≥ 0	198	193
Likelihood Ratio (x^2/df)	< 4.0	1.277	1.154
P value	≥ 0.05	0.005	0.07
Tucker Lewis Index (TLI)	> 0.90	0.956	0.976
Comparative Fit Index (CFI)	> 0.90	0.963	0.98
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.036	0.027
Probability (p-close)	≥ 0.05	0.962	0.997
Hoelter's Critical N (CN)	> 200	192	213

Table 13 indicates the goodness-of-fit statistics of the generic and revised four-factor measurement models of the safety climate construct. The improvement of model fit in the revised model is substantial. Most of the goodness-of-fit statistics and indices were within recommended limits. Therefore, the revised measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the multidimensional latent construct of safety climate.

4.2.2 Endogenous Variables

The self-reported safety behavior and intention variables were validated by confirmatory factor analysis. Intention is a latent construct measured by six items. Self-reported safety behavior was measured via a measurement model with two correlated theoretical constructs: violation and error behavior. First, two major components were validated separately. Then

validated components were integrated as a two-factor measurement model and validated using confirmatory factor analysis.

4.2.2.1 Intention toward Safety

Intention is the mediating variable of the theoretical model. Six indicators were designed to measure individuals' intentions toward safety. A generic measurement model was established with six indicators and validated by confirmatory factor analysis. Most of the factor loadings had critical ratios greater than 1.96, except for the Intention4 indicator. After excluding the Intention4, the remaining indicators had adequate factor loadings ranging from .55 to .70.

Evaluation of the overall fit indicated that model fit was still not within acceptable limits despite significant and high factor loadings. Hence, structural paths were inserted step by step until the model had a reasonably good model fit. Correlating three pairs of error terms ensured that the model had a reasonably good model fit. Figure 9 shows the revised measurement model of the intention construct.

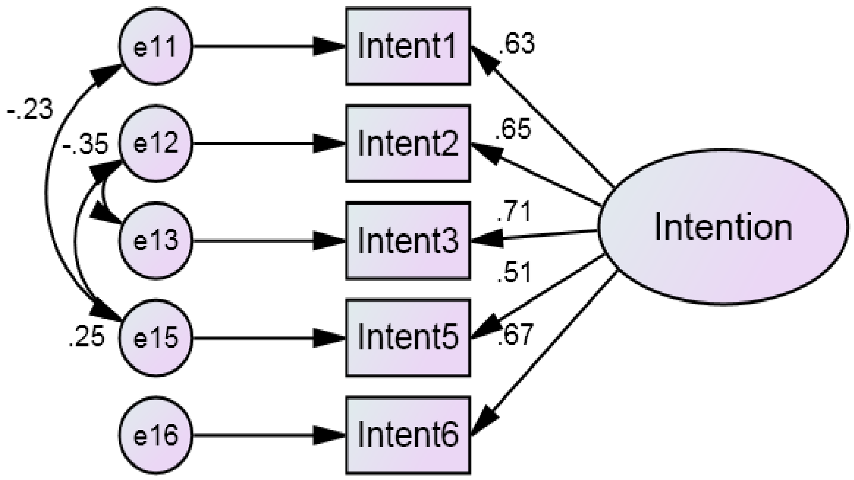

Figure 9. Revised Measurement Model for Intention toward Safety

As seen in Figure 9, all factor loadings have significant values ranging from .514 to .71. Table 14 indicates parameter estimates for generic and revised "Intention" measurement models.

Table 14. Parameter Estimates for the Intention Measurement Models

			Generic Model					Revised Model				
Indicator			**URW**	**SRW**	**SE**	**CR**	**P**	**URW**	**SRW**	**SE**	**CR**	**P**
Intent1	<-	Intention	.684	.583	.102	6.707	***	.768	.629	.103	7.429	***
Intent2	<-	Intention	.782	.634	.110	7.125	***	.833	.650	.130	6.419	***
Intent3	<-	Intention	.745	.630	.105	7.095	***	.874	.710	.119	7.356	***
Intent4	<-	Intention	.242	.129	.150	1.619	.105					
Intent5	<-	Intention	.660	.561	.101	6.501	***	.631	.514	.112	5.618	***
Intent6	<-	Intention	1	.693				1.000	.666			

The goodness-of-fit statistics of the generic and revised measurement models of the intention construct are presented in Table 15.

Table 15. Goodness-of-Fit Statistics for Intention toward Safety

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	Low	52.305	3.174
Degrees of Freedom (df)	≥ 0	9	2
Likelihood Ratio (x^2/df)	< 4.0	5.812	1.587
P value	≥ 0.05	0	0.205
Tucker Lewis Index (TLI)	> 0.90	0.716	0.977
Comparative Fit Index (CFI)	> 0.90	0.83	0.995
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.152	0.053
Probability (p-close)	≥ 0.05	0	0.364
Hoelter's Critical N (CN)	> 200	68	395

The generic and revised measurement models of the intention construct had substantial differences, as seen in Table 15. The difference between the generic and revised models (Δ x^2) was calculated at 49.131, which indicated significant improvement in the revised model. Most of the goodness-of-fit statistics were within the recommended limits in the revised model. Therefore, the revised measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the latent construct of intention toward safety.

The Cronbach's alpha score was computed for the internal consistency of the measurement instrument. The Cronbach's alpha score was .77 for the intention indicators, which was greater than the recommended limit. The reliability of the intention measurement instrument was within satisfactory limits.

4.2.2.2 Violation Behavior

Violation behavior is the first component of the safety behavior measure, containing five indicators. The generic measurement model of violation behavior was established and validated by confirmatory factor analysis. Most of the factor loadings were significant, having critical ratios greater than 1.96. Five indicators had adequate factor loading values ranging from .69 to .73. Evaluation of the overall fit showed that the model had a reasonably good model fit without any revision. Figure 10 shows the final measurement model of the intention construct.

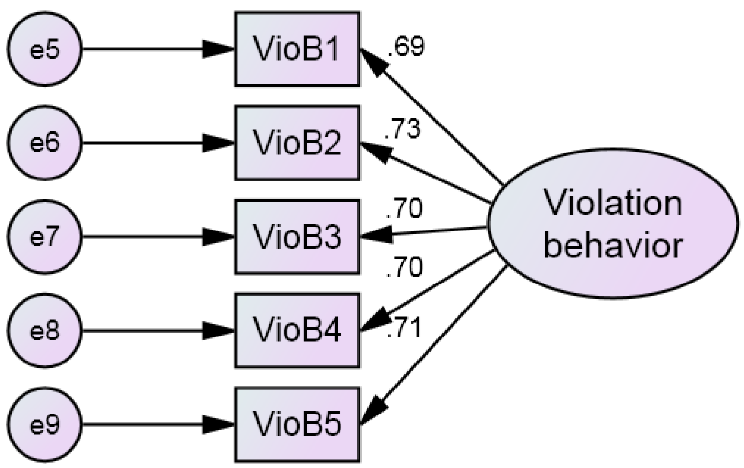

Figure 10. Final Measurement Model for Violation Behavior

As seen in Figure 10, all factor loadings have significant factor loading ranging from .69 to .73. Table 16 indicates the parameter estimates for the violation behavior measurement model.

Table 16. Parameter Estimates for the Violation Behavior Measurement Model

Indicator			URW	SRW	SE	CR	P
VioB1	<-	Violation	.949	.686	.110	8.647	***
VioB2	<-	Violation	.963	.730	.106	9.099	***
VioB3	<-	Violation	.978	.697	.112	8.761	***
VioB4	<-	Violation	.883	.700	.100	8.793	***
VioB5	<-	Violation	1.000	.711			

The violation behavior measurement model indicates a reasonably good fit to the data. The goodness-of-fit statistics of the final measurement model are presented in Table 17.

Table 17. Goodness-of-Fit Statistics for Violation Behavior

Index	Criterion	Final Model
Chi-square (x^2)	low	6.501
Degrees Of Freedom (df)	≥ 0	5
Likelihood Ratio (x^2/df)	< 4.0	1.3
P value	≥ 0.05	0.26
Tucker Lewis Index (TLI)	> 0.90	0.991
Comparative Fit Index (CFI)	> 0.90	0.996
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.038
Probability (p-close)	≥ 0.05	0.526
Hoelter's Critical N (CN)	> 200	356

Most of the goodness-of-fit statistics were within recommended limits in the revised model. Therefore, the final measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the latent construct of violation behavior. For the reliability test, the Cronbach's alpha score was computed with the five indicators. The violation behavior measurement instrument had a Cronbach's alpha value of .831, which was

greater than the recommended limit. The internal consistency of the measurement instrument was at the satisfactory level.

4.2.2.3 Error Behavior

The second component of the safety behavior construct is error behavior, measured by four indicators. A generic measurement model was established and validated by confirmatory factor analysis. As a result, all indicators had critical ratios greater than 1.96. Most of the factor loadings had values over .50. Evaluation of the overall fit showed that the model fit was within acceptable limits. Figure 11 shows the final measurement model for error behavior.

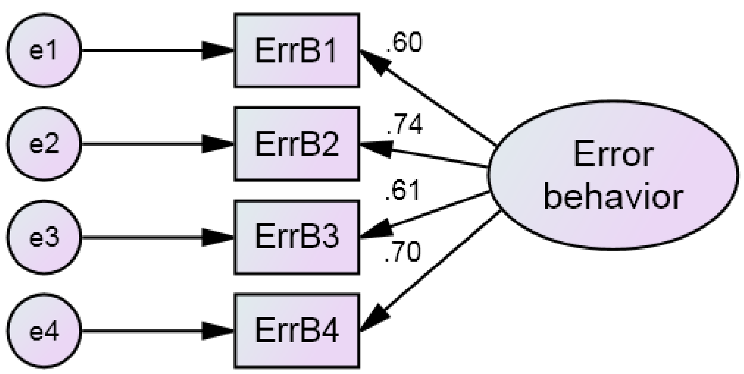

Figure 11. Final Measurement Model for Error Behavior

As seen in Figure 11, all factor loadings have significant factor loadings ranging from .60 to .74. Table 18 indicates the parameter estimates for the “Error Behavior” measurement model.

Table 18. Parameter Estimates for the Error Behavior Measurement Model

Indicator			**URW**	**SRW**	**SE**	**CR**	**P**
ErrB1	<-	Error	.857	.604	.123	6.992	***
ErrB2	<-	Error	.956	.742	.123	7.792	***
ErrB3	<-	Error	.819	.609	.116	7.035	***
ErrB4	<-	Error	1.000	.701			

The error behavior measurement model indicates a reasonably good fit to the data. The goodness-of-fit statistics of the final measurement model are documented in Table 19.

Table 19. Goodness-of-Fit Statistics for Error Behavior

Index	**Criterion**	**Final Model**
Chi-square (x^2)	low	6.232
Degrees of Freedom (df)	≥ 0	2
Likelihood Ratio (x^2/df)	< 4.0	3.116
P value	≥ 0.05	0.044
Tucker Lewis Index (TLI)	> 0.90	0.934
Comparative Fit Index (CFI)	> 0.90	0.978
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.101
Probability (p-close)	≥ 0.05	0.125
Hoelter's Critical N (CN)	> 200	201

As seen in Table 19, most goodness-of-fit statistics are in the recommended limits, except for the p-value of the chi-square test and the RMSEA. However, all critical ratios are significant and the factors have adequate loadings. Therefore, the final measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the latent construct of error behavior. To assess the internal consistency of the measurement instrument,

the Cronbach's alpha score was computed. The error behavior measurement instrument had a Cronbach's alpha score of .76, which was greater than the recommended level. The reliability of the error behavior measurement instrument was satisfactory.

4.2.2.4 Safety Behavior

The safety behavior measurement model was established by two correlated constructs, including violation and error behaviors. The same principles of confirmatory factor analysis were applied to validate the two-factor measurement model of safety behavior. Safety behavior is conceptualized as a multi-dimensional construct (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; 2003). The validated components of safety behavior were aggregated into one measurement model and validated by confirmatory factor analysis.

Most of the indicators of the two-factor measurement model were significant, having critical ratios greater than 1.96. All the factor loadings were greater than .50, ranging from .62 to .73. Evaluation of the overall fit indicated that the model fit was within acceptable limits without any revision. Figure 12 shows the final measurement model for the safety behavior construct.

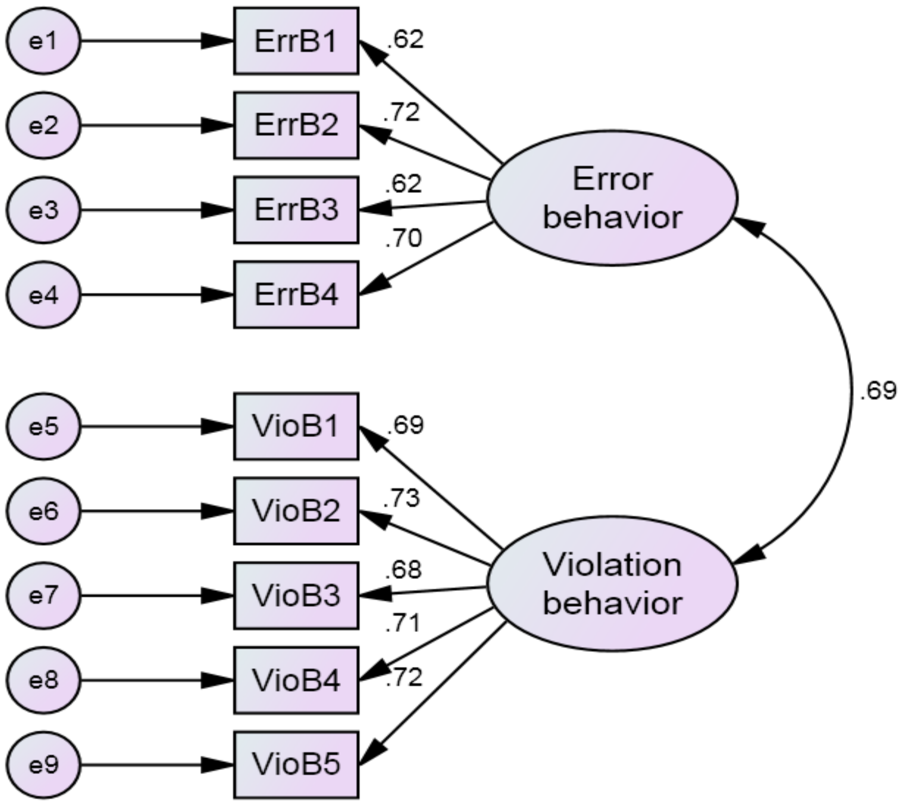

Figure 12. Revised Measurement Model for Safety Behavior

Most of the indicators of the two-factor measurement model have significant factor loadings ranging from .62 to .73. A relatively high correlation was found between violation and error behavior at the .05 significance level (r= .69). The parameter estimates of the safety behavior measurement model are presented in Table 20.

Table 20. Parameter Estimates for the Safety Behavior Measurement Model

Indicator			URW	SRW	SE	CR	P
ErrB1	<-	Error	1.000	.621			
ErrB2	<-	Error	1.062	.725	.139	7.630	***
ErrB3	<-	Error	.941	.617	.137	6.885	***
ErrB4	<-	Error	1.129	.697	.151	7.471	***
VioB1	<-	Violation	1.000	.691			
VioB2	<-	Violation	1.005	.728	.111	9.059	***
VioB3	<-	Violation	1.002	.682	.117	8.575	***
VioB4	<-	Violation	.931	.705	.105	8.825	***
VioB5	<-	Violation	1.053	.716	.118	8.935	***

The safety behavior measurement model has a good fit to the data. Goodness-of-fit statistics for the final measurement model are presented in Table 21.

Table 21. Goodness-of-Fit Statistics for Safety Behavior

Index	Criterion	Final Model
Chi-square (x^2)	low	24.338
Degrees of Freedom (df)	≥ 0	26
Likelihood Ratio (x^2 /df)	< 4.0	0.936
P value	≥ 0.05	0.557
Tucker Lewis Index (TLI)	> 0.90	1.004
Comparative Fit Index (CFI)	> 0.90	1
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0
Probability (p-close)	≥ 0.05	0.948
Hoelter's Critical N (CN)	> 200	334

As seen in Table 21, most of the goodness-of-fit statistics are within the recommended limits. Moreover, all critical ratios are significant and factors have adequate loadings. Therefore,

the final measurement model demonstrates an acceptable fit of the model to the data and is confirmed as a measurement model for the latent construct of safety behavior.

4.3 Structural Equation Modeling

The third part of the statistical analysis is Structural Equation Modeling (SEM). After validating the measurement models, a covariance structure model was created and validated based on the goodness-of-fit statistics. SEM consists of measurement models of exogenous and endogenous variables, as well as control variables. This study had seven latent constructs including management attitude, own attitude, group norms, workplace pressures, intention, violation behavior, and error behavior. Safety climate is the exogenous variable, conceptualized as a four-factor measurement model. Safety behavior is the endogenous variable, conceptualized as a two-factor measurement model. Accordingly, a generic structural equation model was established by connecting the exogenous and endogenous variables based on the theoretical framework, which proposed that safety climate has a positive effect on individual's safety behavior. The validated measurement models were connected with the control variables to identify the organizational and demographic variables that account for the variation in study constructs. The generic structural equation model of safety behavior is presented in Figure 13.

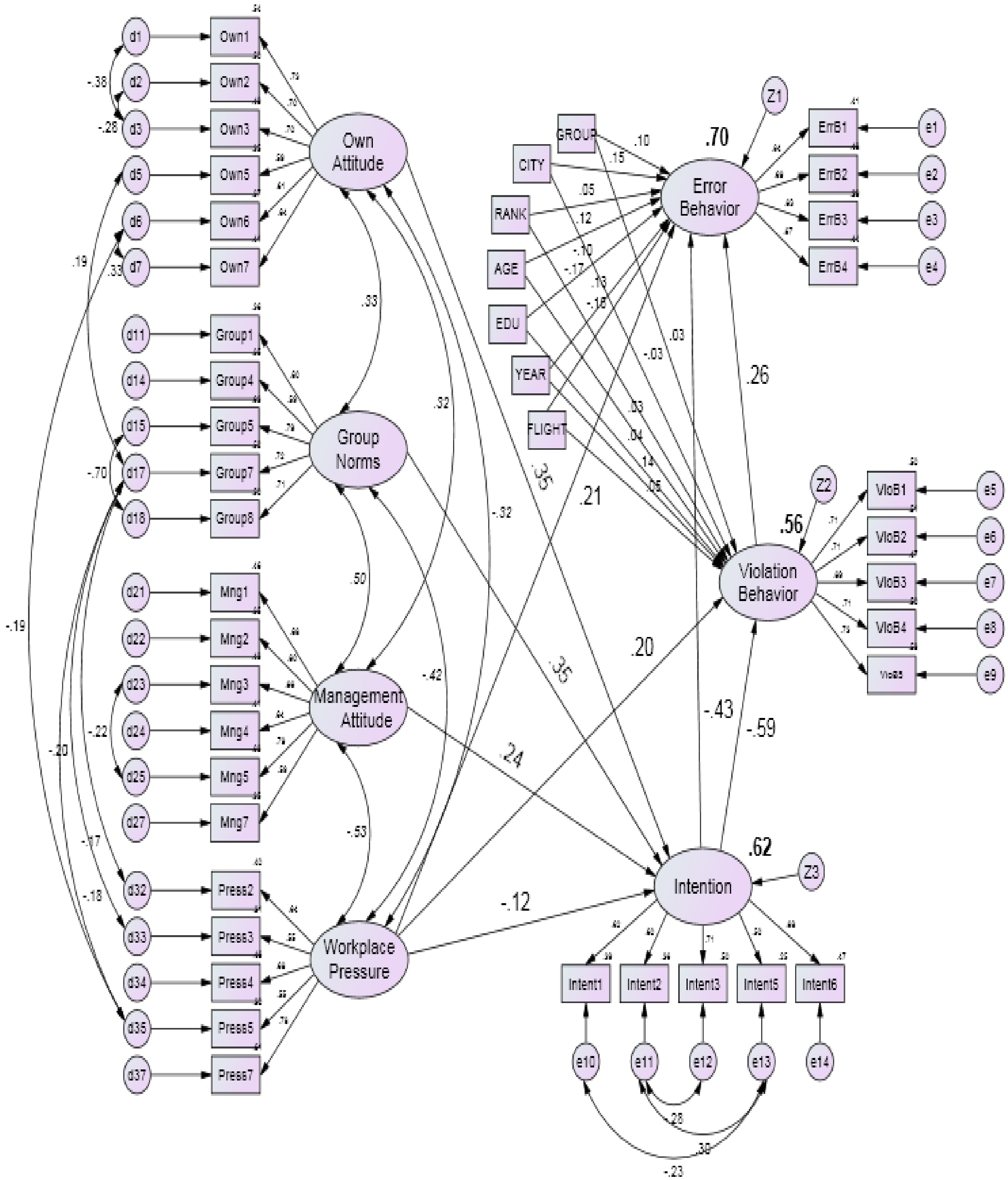

Figure 13. Generic Structural Equation Model for Safety Behavior

The structural equation model was validated based on Wan's (2002) three-stage method. First, a theoretical structural equation model was established as seen in the figure. Given parameter estimates and standard errors, factor loadings and correlations having not statistically significant p-values were identified. These factor loadings and correlations were eliminated from the model one at a time until all variables had significant p values at the .05 level. The task group variables were re-coded as three dummy variables to observe subgroup differences, which was the third hypothesis. However, the relations between the endogenous variable (violation and error behavior) and the three dummy variables were not statistically significant. As a result, age and years of service were retained in the structural equation model because they had significant critical ratios at the .05 level. Task group variables (dummy variables recoded as pilot, maintenance, and office staff), and control variables (city, rank, education, and flight hours) were excluded from the model because they did not have statistically significant p-values. Variables having not statistically significant p-values were removed from the model one at a time until all variables had p-values smaller to .05. Likewise, the regression path between workplace pressures and intention constructs was removed because it did not have statistically significant critical ratios.

After removing variables and paths having not statistically significant p-values, SEM analysis was conducted again. All critical ratios were significant at the .05 level for the remaining items. Table 22 shows the parameter estimates for the generic and revised structural equation models.

Table 22. Parameter Estimates for the Generic and Revised SEM

Indicator			Generic Model					Revised Model				
			URW	SRW	SE	CR	P	URW	SRW	SE	CR	P
Intent	<-	Own	.334	.350	.08	4.46	***	.326	.343	.07	4.48	***
Intent	<-	Group	.350	.346	.09	4.07	***	.427	.439	.09	4.69	***
Intent	<-	Manegm	.203	.240	.07	2.76	.006	.194	.245	.06	3.08	.002
Intent	<-	Press	-.092	-.117	.07	-1.41	.159					
Viol.B.	<-	Intent	-.855	-.585	.15	-5.64	***	-.840	-.582	.15	-5.59	***
Viol.B.	<-	Press	.235	.204	.10	2.42	.016	.264	.234	.10	2.76	.006
Viol.B.	<-	AGE	.039	.034	.07	0.59	.555					
Viol.B.	<-	EDU	.039	.043	.05	0.75	.456					
Viol.B.	<-	YEAR	.099	.138	.04	2.35	.019	.110	.156	.04	2.59	.010
Viol.B.	<-	FLIGHT	.022	.052	.02	0.90	.368					
Viol.B.	<-	RANK	-.124	-.174	.04	-2.94	.003					
Viol.B.	<-	CITY	-.013	-.027	.03	-0.47	.637					
Viol.B.	<-	GROUP	.023	.025	.05	0.44	.660					
Err.B.	<-	Intent	-.451	-.433	.12	-3.63	***	-.477	-.460	.12	-3.84	***
Err.B.	<-	Viol.B.	.185	.260	.08	2.28	.022	.177	.246	.08	2.20	.028
Err.B.	<-	Press	.172	.210	.07	2.45	.014	.185	.228	.07	2.64	.008
Err.B.	<-	GROUP	.067	.105	.04	1.81	.070					
Err.B.	<-	CITY	.053	.152	.02	2.60	.009					
Err.B.	<-	RANK	.023	.046	.03	0.77	.444					
Err.B.	<-	AGE	.094	.116	.05	2.00	.046	.140	.173	.05	2.86	.004
Err.B.	<-	EDU	-.066	-.103	.04	-1.78	.075					
Err.B.	<-	YEAR	.068	.134	.03	2.23	.026					
Err.B.	<-	FLIGHT	-.045	-.151	.02	-2.58	.010					
Own7	<-	Own	1.000	.642				1.000	.645			
Own6	<-	Own	1.005	.610	.11	9.45	***	1.006	.611	.11	9.42	***
Own5	<-	Own	.985	.591	.13	7.44	***	1.008	.602	.13	7.63	***
Own3	<-	Own	1.008	.697	.14	7.22	***	.996	.691	.14	7.31	***
Own2	<-	Own	.998	.704	.13	7.95	***	1.007	.707	.12	8.13	***
Own1	<-	Own	1.241	.733	.15	8.14	***	1.235	.732	.15	8.35	***
Group8	<-	Group	1.337	.710	.18	7.63	***	1.242	.681	.16	7.59	***
Group7	<-	Group	1.559	.723	.18	8.47	***	1.683	.815	.21	8.12	***
Group5	<-	Group	1.330	.794	.16	8.27	***	1.138	.695	.15	7.62	***
Group4	<-	Group	.989	.589	.14	7.19	***	.795	.492	.13	6.06	***
Group1	<-	Group	1.000	.597				1.000	.627			
Mng7	<-	Manegm	1.095	.592	.14	7.61	***	1.026	.592	.13	7.79	***
Mng5	<-	Manegm	1.420	.794	.15	9.44	***	1.291	.771	.13	9.91	***

Mng4	<-	Manegm	1.170	.642	.14	8.19	***	1.048	.611	.13	8.00	***
Mng3	<-	Manegm	.996	.656	.13	7.95	***	.861	.602	.11	7.89	***
Mng2	<-	Manegm	.977	.595	.13	7.65	***	.962	.626	.13	7.44	***
Mng1	<-	Manegm	1.000	.680				1.000	.726			
Press7	<-	Press	1.212	.784	.14	8.49	***	1.208	.788	.14	8.70	***
Press5	<-	Press	.927	.548	.14	6.62	***	.961	.566	.14	6.89	***
Press4	<-	Press	1.452	.678	.19	7.77	***	1.417	.668	.18	7.81	***
Press3	<-	Press	1.080	.553	.16	6.61	***	1.108	.568	.16	6.87	***
Press2	<-	Press	1.000	.635				1.000	.639			
ErrB1	<-	Err.B.	1.000	.639				1.000	.634			
ErrB2	<-	Err.B.	.989	.695	.12	7.97	***	.995	.693	.13	7.87	***
ErrB3	<-	Err.B.	.933	.628	.13	7.39	***	.936	.625	.13	7.29	***
ErrB4	<-	Err.B.	1.049	.666	.14	7.73	***	1.096	.691	.14	7.85	***
VioB1	<-	Viol.B.	1.000	.710				1.000	.707			
VioB2	<-	Viol.B.	.957	.712	.10	9.29	***	.913	.676	.11	8.60	***
VioB3	<-	Viol.B.	.984	.689	.11	9.01	***	.927	.646	.11	8.23	***
VioB4	<-	Viol.B.	.909	.707	.10	9.23	***	.923	.715	.10	9.12	***
VioB5	<-	Viol.B.	1.046	.730	.11	9.51	***	1.044	.726	.11	9.24	***
Intent6	<-	Intent	1.344	.684	.17	7.97	***	1.356	.689	.17	8.01	***
Intent5	<-	Intent	.802	.497	.15	5.52	***	.804	.497	.15	5.52	***
Intent3	<-	Intent	1.144	.709	.14	8.10	***	1.138	.705	.14	8.06	***
Intent2	<-	Intent	1.010	.600	.14	7.03	***	1.007	.598	.14	7.02	***
Intent1	<-	Intent	1.000	.625				1.000	.624			

As seen in Table 22, all critical ratios are significant at the .05 level for the revised model. Likewise, all factor loadings are greater than .50. The model improved after removing variables and pathways having not statistically significant p-values. However, the overall fit of the structural equation model was still not within acceptable limits. Hence, the structural equation model was evaluated to identify the reasons for the lack of fit (Wan, 2002). The measurement errors of indicators were correlated based on the modification indices to improve the model fit (Hox & Bechger, 1998; Wan, 2002; Schumacker & Lomax, 2004). Goodness-of-fit statistics were observed after each correlated pair of errors. The goodness-of-fit statistics showed

substantial improvement through the process, and the revised structural equation model had a reasonably good model fit. The differences between the goodness-of-fit statistics of the generic and revised structural equation models are presented in Table 23.

Table 23. Goodness-of-Fit Statistics for the Generic and Revised SEM

Index	**Criterion**	**Generic Model**	**Revised Model**
Chi-square (x^2)	low	1820.533	683.087
Degrees of Freedom (df)	≥ 0	825	627
Likelihood Ratio (x^2/df)	< 4.0	2.207	1.089
P value	≥ 0.05	0	0.06
Tucker Lewis Index (TLI)	> 0.90	0.694	0.977
Comparative Fit Index (CFI)	> 0.90	0.721	0.980
Root Mean Square Error Of Approximation (RMSEA)	≤ 0.05	0.076	0.021
Probability (p-close)	≥ 0.05	0	1
Hoelter's Critical N (CN)	> 200	103	211

As seen in Table 23, most of the goodness-of-fit parameters for the revised structural equation model are within recommended limits. Improvement of the model fit in the revised model is substantial. The difference between the generic and revised model (Δx^2) is calculated at 1137.446, indicating significant improvement of model fit in the revised model. Most of the goodness-of-fit statistics are within recommended limits. Overall, the revised structural equation model provided a satisfactory fit to the data. Figure 14 shows the revised structural equation model of the study.

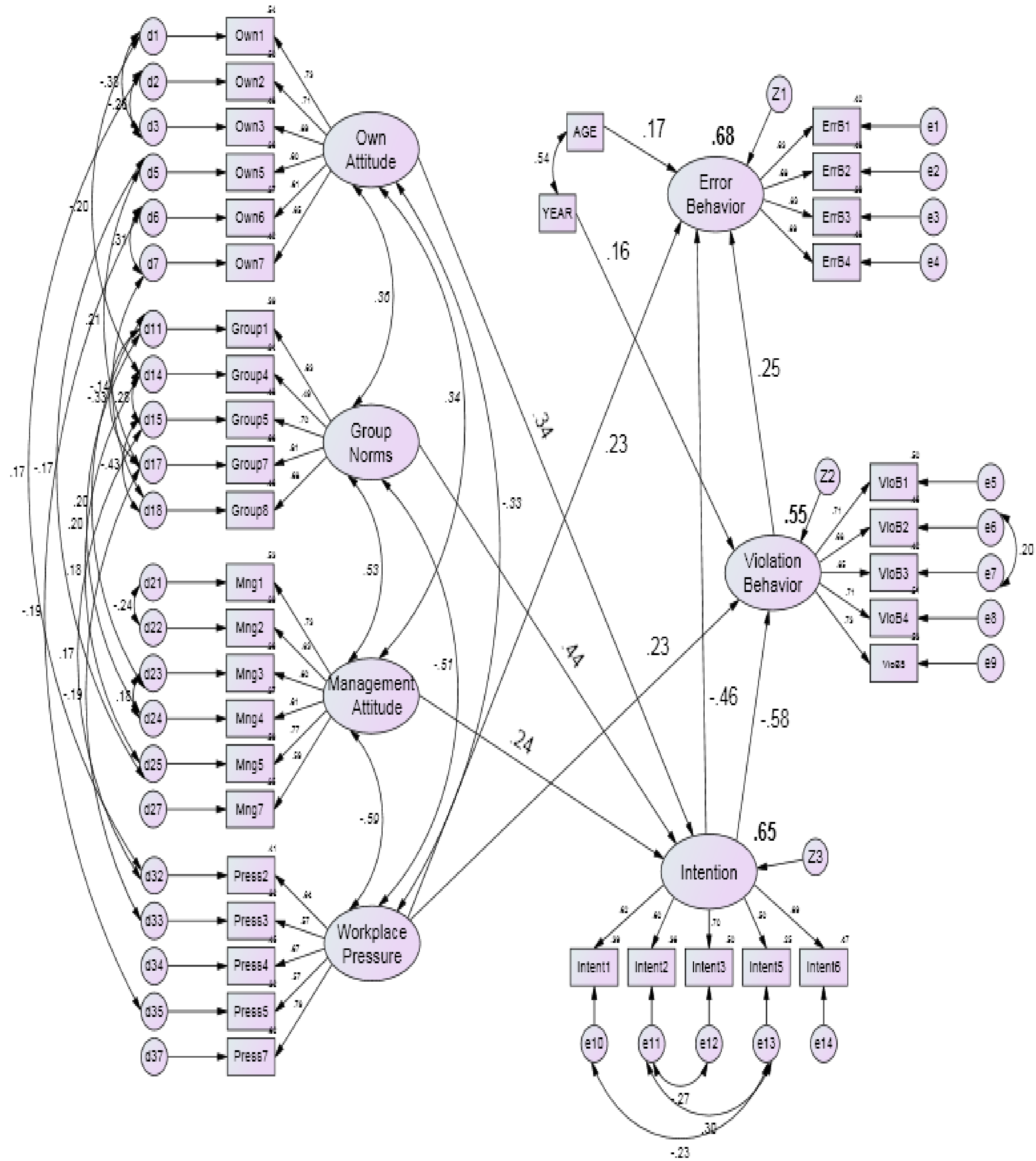

Figure 14. Revised Structural Equation Model for Safety Behavior

According to the revised SEM results, it was demonstrated that the safety climate of the TNP Aviation Department influences individuals' safety behavior. As anticipated, intention is the mediating variable, which strengthens the relationship between safety climate and safety behavior. While age has a positive significant relationship with error behavior (r= .173, p= .01), years of service has a positive significant relationship with violation behavior (r= .156, p= .01). Overall, these predictor variables accounted for 65% of variance in intention, 55% of the variance in violation behavior, and 68% of variance in error behavior.

The influences of the variables were classified as partially and fully mediated effects. The term *partially mediated through the mediator variable* means that the variable has significant direct and indirect effects on the endogenous variable. The relation between the workplace pressures and error variables is an example of a partially mediated effect. On the other hand, the term *fully mediated through the mediator variable* means that the variable has no direct effect, but does have a significant indirect effect on the endogenous variable (MacKinnon, Krull, & Lockwood, 2000). The relation between own attitude and violation is a fully mediated effect through the mediator variable, which is the intention in this case. Table 24 presents the direct, indirect, and total effects of each variable in the model on error and violation behavior.

Table 24. Effects of Exogenous Variables on Endogenous Variables

Exogenous variables		**Endogenous variable**	**DIRECT β**	**INDIRECT β**	**TOTAL β**	**TYPE**
Own Attitude	-->	Violation		-0.2	-0.2	Fully mediated
Group Norms	-->	Violation		-0.255	-0.255	Fully mediated
Management Att.	-->	Violation		-0.142	-0.142	Fully mediated
Workplace Press.	-->	Violation	0.234		0.234	Direct effect
Intention	-->	Violation	-0.582		-0.582	Direct effect
Year	-->	Violation	0.156		0.156	Direct effect
Own Attitude	-->	Error		-0.207	-0.207	Fully mediated
Group Norms	-->	Error		-0.264	-0.264	Fully mediated
Management Att.	-->	Error		-0.148	-0.148	Fully mediated
Workplace Press.	-->	Error	0.264	0.058	0.322	Partially mediated
Intention	-->	Error	-0.46	-0.143	-0.603	Partially mediated
Violation	-->	Error	0.246		0.246	Direct effect
Age	-->	Error	0.173		0.173	Direct effect

Note: All correlations are significant at the p= .05 level.

As seen in Table 24, own attitude, group norms, and management attitude have fully mediated effects on violation and error behaviors, as assumed by the theory of planned behavior. However, “workplace pressures” does not have indirect effects mediated by the intention variable. The only assumed relation having not statistically significant p-value was between workplace pressures and intention. Workplace pressures had direct and indirect effects (mediated by violation) on error behavior. Likewise, intention had direct and indirect effects (mediated by violation) on error behavior. Control variables, age, and years of services had significant direct effects on the endogenous variables. Based on the SEM results, the study’s hypothesis testing is discussed in the following section.

4.4 Hypothesis Testing

Four research hypotheses were tested through this study:

H_1: Police Aviation Department employees' safety climate perceptions of their organization positively affect their self-reported safety behaviors, holding demographic and organizational factors constant.

H_2: Organizational size, rank, age, educational level, service years, and flight hours are positively associated with self-reported safety behavior.

H_3: There are differences among pilots, maintenance staff, and office staff based on their self-reported safety behaviors.

H_4: Regarding safety climate dimensions, individual own attitude, group norms, and management attitude are positively correlated with each others, and negatively correlated with workplace pressures.

Based on the results, the first hypothesis, that organizational safety climate influences individuals' safety behavior, is supported. Assuming intention as a mediating variable between the exogenous and endogenous variables, the safety climate of the organization positively influences individuals' safety behavior. Each component of the safety climate has a significant influence on safety behavior components. Significant direct and indirect relations between the components were presented in the table 24. Own attitude (r= -.2, p=.05), group norms (r=-.25, p= .05), and management attitude (r= -.142, p= .05) have significant negative indirect effects on violation behavior, mediated by the intention variable. Likewise, own attitude (r= -.207, p= .05),

group norms (r= -.264, p= .05), and management attitude have significant negative indirect effects on error behavior, mediated by the intention variable. Workplace pressures had a significant positive direct effect on violation behavior (r= .234, p= .05), as well as error behavior (r= .264, p= .05). Workplace pressures also had a significant positive indirect effect on error behavior (r= .058, p= .05), mediated by violation behavior. Using Ajzen's theory of planned behavior, the only relation having not statistically significant p-value was found between workplace pressures and the intention variable, and it was excluded from the final model. The results demonstrate that the safety climate of the TNP police aviation organization positively influences individuals' safety behavior.

The second hypothesis is not supported, according to findings that organizational size, rank, age, educational level, service years, and flight hours are not positively associated with self-reported safety behavior. However, the relationship between age and error behavior (r= .173, p= .01), as well as years of service and violation behavior (r= .156, p= .01) were found to be significant despite the original supposition that a reversed relationship would appear. Accordingly, individuals' self-reported error behaviors increase as they age. As well, individuals' self-reported violation behaviors increase as their years of service increase. Overall, along with safety climate, these predictor variables accounted for 65% of the variance in intention, 55% of the variance in violation behavior, and 68% of the variance in error behavior.

The third hypothesis is not supported, according to the findings. There is no significant difference among pilots, maintenance personnel, and office staff based on their self-reported safety behaviors. Therefore, it is concluded that pilots, maintenance personnel, and office staff

working in the TNP Aviation Department do not differ based on their self-reported safety behaviors.

The last hypothesis is supported that individual own attitude, group norms, and management attitude are positively correlated with each others, and negatively correlated with workplace pressures. Individual attitude has positive correlations with group norms (r= .36, p= .01), management attitude (r= .338, p= .01), and a negative correlation with workplace pressures (r= -.334, p= .01). "Group norms" has a positive correlation with management attitude (r= .525, p= .01), and a negative correlation with workplace pressures (r= -.506, p= .01). Lastly, management attitude has a negative correlation with workplace pressures (r= -.59, p= .05).

Based on the study findings, the influence of organizational safety culture on individual safety behavior was demonstrated. Except for the positive relationship between age and error behavior, and years of service and violation behavior, no significant relationship was found between demographic/organizational attributes and individual safety behavior. No significant difference was found among pilots, maintenance personnel, and office staff. Lastly, significant correlations were found between safety climate dimensions. In the following chapter, study findings were discussed, theoretical, policy, and managerial implications were presented. Conclusion, limitations of the study, and future studies were discussed in detail.

CHAPTER 5 DISCUSSION, IMPLICATIONS, CONCLUSION, AND LIMITATIONS

This study was designed to answer the question "What is the influence of organizational safety culture on an individual's safety behavior in a high-risk environment?" The study found that, in the case of the TNP Aviation Department, employees' perceptions of the organizational safety climate positively affected their self-reported safety behaviors, holding demographic and organizational factors constant. Positive significant correlations were found between age and error behavior, as well as between years of service and violation behavior. No significant difference was observed among the subgroups based on employees' safety behavior variance. Significant correlations were found among safety climate dimensions. These findings are discussed in detail in the following topic. The implications of the study are separated into three topics: theoretical, policy, and managerial. The conclusion and limitations of the study are then discussed. Lastly, future studies are recommended.

5.1 Discussion

The impact of organizational safety culture on individuals' safety behavior was demonstrated using the theory of planned behavior (TPB). The variance of individuals' safety behavior in an organization is explained via the study model established by Ajzen's theory. Fogarty and Shaw (2009) argued that TPB does not lend itself to the study of unintentional error behavior; however, the intention construct was designed to reflect an individual's motivational factors, including safety commitment, value expectancy for pre-checking, standpoint regarding

risk-taking behavior, and attitude toward safety regulations. The relation between individuals' intentions toward safety and their error behavior was established in the model because it was assumed that individuals lower in motivational factors would be more likely to perform error behaviors. Overall assessment of the study indicated that TPB is useful in explaining individual safety behavior variance in relation to the influence of organizational safety culture. A more detailed assessment was performed by focusing on the relations between the sub-components of organizational safety climate and individual safety behavior.

Safety climate was conceptualized as a multidimensional construct having four components. Based on the TPB, own attitude, group norms, management attitude, and workplace pressures were correlated with each other to observe the perceived safety climate of the TNP Aviation Department. The four-factor measurement model of organizational safety climate fit reasonably well to the data, and most correlations between the safety climate components were significant at the .05 level. Correlations between own attitude and the other three components were relatively low (r= -.334 for workplace pressures, r= .338 for management attitude, and r= .36 for group norms). On the other hand, correlations between group norms and management attitude (r= .525), as well as workplace pressures (r= -.506), were relatively high. The highest correlation occurred between workplace pressures and management attitude (r= -.59, p= .05).

The safety climate components had different standardized regression weights on the exogenous variables. In the case of the TNP Aviation Department, the component most influential on the exogenous variable was the group norms variable, which had the greatest influence on individuals' intention (r= .43, p= .05) and violation behavior (r= -.255, p= .05), and

(after workplace pressures) the second greatest influence on error behavior (r= -.264, p= .05). A similar study (Fogarty & Shaw, 2009) conducted on the Australian Air Force, on the other hand, highlighted management attitude as the most influential construct of the model. The differences between the two studies may be attributable to national culture, which influences individuals' values, attitudes, and behaviors (Hofstede et al., 1990; Helmreich & Merritt, 2001). According to the Hofstede Cultural Dimensions scale, Turkish culture is highly collectivist; members of the culture have strong, cohesive in-group ties and are influenced by others in the integrated group. On the other hand, Australian culture demonstrates dominant individualistic characteristics, loose ties, and weak influence among individuals (Hofstede, 2010).

Own attitude had the second greatest influence on individuals' intentions (r= .34, p= .05) and violation behavior (r= -.2, p= .05), and the third greatest influence on error behavior (r= -.207, p= .05). Management attitude had a relatively weak influence on individuals' intention (r= .172, p= .05), violation behavior (r= -.142, p= .05), and error behavior (r= -.148, p= .05) as compared with other components, as well as compared with Fogarty and Shaw's (2009) study. The differences in the influence of management attitude between the two studies can be explained by the difference between individual and collective cultures. While people living in an individualistic culture may focus on management attitude in order to avoid difficulty in the workplace, collective cultures encourage individuals to support each other in establishing group solidarity against management enforcement.

The workplace pressures component was designed to observe employees' experiences and anticipated obstacles regarding the ease or difficulty of working with safety procedures.

Lack of available safety instruments, lack of time and personnel, and pressures exerted by the organization, customers, peer, and self were assumed to influence individuals' intention toward safety and safety behavior (Ajzen, 1991; Fogarty & Shaw, 2009). Workplace pressures had a significant positive influence on violation behavior ($r= .234$, $p= .05$) and error behavior ($r= .322$, $p= .05$). However, the relationship between the workplace pressures and intention variables was found to be not statistically significant in the case of the TNP Aviation Department, despite the assumptions made on the basis of TPB. The only relationship having not statistically significant p-values in the model can be accounted for by national culture, as TPB was constructed in a western culture. Turkish culture focuses on individuals' intentions rather than the consequences of their actions. Intention is the most important thing—if not everything—in evaluating individuals' behavior in Turkish culture. Hence, individuals are encouraged to have good intentions despite the presence of barriers and pressures that may affect their fulfillment of the intended task. The influence of workplace pressures on intention was found not statistically significant in this study, which can be attributed to Turkish national culture's attaching different and stronger meanings to intention relative to western culture.

The relationship between violation behavior and error behavior was also found to be significant, with a standardized regression coefficient of .246. Safety behavior was conceptualized as a two-factor model and separated into two components: violation and error behavior. *Violation behavior* refers to willful disregard for formal safety regulations and procedures, and was classified in two ways: routine and exceptional. On the other hand, *error behavior* occurs when an individual's activities accidentally fail to achieve an intended outcome. Error behavior was classified into three categories: decision, skill-based, and perceptual

(Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003). The causal mechanism between the violation and error constructs was assumed to be a significant positive influence of violation behavior on error behavior. Violations create errors because disregarding safety regulations can result in activities that accidentally fail to achieve intended outcomes. However, errors do not necessarily involve violations, because violation consists of intentional and willful disregard for safety regulations.

The influence of an individual's age on error behavior was significant at the .05 level, with a standardized regression coefficient of .173. This positive relationship shows that one standard deviation increase in an individual's age results in a .173 standard deviation increase in error behavior. In other words, older employees of the TNP Aviation Department are more likely than younger employees to perform error behaviors. Aging may erode employees' attention, concentration, and information-retaining ability, leading to incorrect decisions, improper judgments, and inaccurate responses. The years of service variable had a significant correlation with three error indicators. The first significant correlation was with the Error1 indicator (r= .224, p= .05), which observed decision errors arising from improper choices and poorly executed procedures. Other significant correlations were with the Error3 (r= .203, p= .05) and Error4 (r= .295, p= .01) indicators, designed to observe perceptual errors arising from imperfect or inadequate information, misjudgments, and responding incorrectly to a diverse of visual and vestibular illusions (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; Wiegmann & Shappell, 2003).

The second significant finding related to demographic and organizational factors was the relationship between years of service and violation behavior, which had a standardized regression coefficient of .156. This positive relationship means that one standard deviation increase in an individual's service years results in a .156 standard deviation increase in violation behavior. In other words, the more experienced TNP Aviation Departments employees are, the more frequently they violate safety regulations and procedures. It had initially been assumed that experienced employees worked more safely than newly recruited ones. The extreme confidence of experienced employees may lead them to take shortcuts and engage in risk-taking behaviors. Indeed, the years of service variable had a significant correlation with the Violation4 indicator ($r= .155$, $p= .05$), which aimed to observe the extent to which individuals violate regulations to make their jobs easier; and the Violation5 indicator ($r= .144$, $p= .05$), which aimed to observe individuals' confidence in their responsibilities regarding job safety.

The control variables of task group, assigned city, rank, education, and flight hours were found to have not statistically significant relations to safety behavior. Additionally, the relations between age and violation behavior and years of service and error behavior were also not statistically significant using a .05 level of significance.

5.2 Implications

The theoretical, policy, and managerial implications of the study findings are discussed in the next three sections.

5.2.1 Theoretical Implications

The theory of planned behavior was tested in this study, and its usefulness in explaining individual safety behavior variance was demonstrated. However, the findings of the study make it evident that safety culture studies and models should take into account the impact of national culture, because concepts have different meanings and weights in different cultures. According to Helmreich and Merritt (2001), aviation culture has been designed for Anglo-Saxon culture and can be modified according to cultural and ethical differences. Differences between Anglo-Saxon culture and Turkish culture emerged in the study findings. The study model and constructs were established based on the theory of planned behavior (TPB), which was established for a western culture dominated by Anglo-Saxon countries. The findings of this study indicated that TBP could be modified to account for national culture differences.

The influence of national culture on individual behavior can be explained by ethical considerations. Ethical theories consider the application of rules with different viewpoints. Deontological ethics strongly emphasizes the moral importance of means and rules to justify an action. On the other hand, in teleological ethics the moral value of an act, rule, or policy emerges from its consequences rather than its intentions or motives (McKinnon, 2004). As regards the intention construct, Turkish culture more closely echoes deontological ethics, which focuses on individuals' intentions rather than the consequences of their actions. The intention of the individual is the most important factor in justifying a performed behavior, even if the action fails to achieve its objectives or outcomes due to disregard for formal safety regulations. Hence, assumed but rejected relationship between workplace pressures and the intention variable can be

accounted for the cultural difference of Turkey because respondents struggle to have good intentions toward safety despite pressures in the workplace that do not support safety. However, the direct influences of workplace pressures on violation and error behaviors are significant, as TPB assumes. The findings of the study supported the rationale that TNP Aviation Employees have good intentions despite barriers and pressures that may impede performance. Their behaviors are more likely to be influenced by workplace pressures that potentially lead to violation and error behaviors. The respondents wish to be consistent in their intentions towards safety, which is independent of workplace pressures because of their self-concepts as conscientious. Safety-minded officers are prized in the Turkish culture.

Other than workplace pressures, three components of safety climate directly influence the intention variable, which mediates the relationship between organizational safety climate and individual safety behavior, as TPB assumes. Fogarty and Shaw (2009), who conducted their study in the dominantly individualist country of Australia (Hofstede, 2010), emphasized management attitude as the most influential construct in their study. For this study, the most influential component was group norms, indicating that Australian Aviation Department employees' safety behaviors are most influenced by their colleagues' attitudes toward safety. According to Hofstede (2010), individuals living in individualist cultures have loose bonds with others. On the other hand, individuals in collectivist cultures are integrated into groups and strongly influenced by others. Considering the cultural differences between western countries and Turkey, results that indicate a strong influence of group norms on safety behavior in the Turkish case and a strong influence of management attitude on safety behavior in the Australian case are reasonable.

This study makes several theoretical contributions to the current literature. First, carefully designed safety climate survey instruments, as well as measurement models of safety climate and safety behavior, were confirmed by confirmatory factor analysis and reliability tests. The four-factor model of organizational safety climate and the two-factor model of individual safety behavior were conceptualized and used in this study. Both multidimensional measurement models indicated a good fit to the data. The study survey can be used to evaluate the effects of any intervention program on improving the safety culture of an aviation organization. In addition, the generic nature of the survey lends itself to use in other aviation organizations regardless of the task performed. Second, the influence of informal structures in the workplace on individuals was demonstrated in the case of the TNP Aviation Department. As emphasized by natural theories, individuals are shaped not only by prescribed rules, regulations, and job descriptions, but also by informal structures emerging from human interaction, individual characteristics, and human relations (Scott, 1998).

5.2.2 Policy Implications

The most important policy implication presented by this study relates to the emergence of informal organizational structures. Examples of organizational structures include prescribed rules, regulations, job descriptions, and work flow charts, which are not adequate to ensure a safe workplace environment. However, individuals bring to the workplace their own ideas, interests, and values that shape the informal structure of the organization and present a platform for positive influence (Scott, 1998). This study demonstrated the influence of organizational safety culture on individual safety behavior in the TNP Aviation Department. Organizations performing

in high-risk environments should consider the influence of informal structures while designing their safety systems, safety policies, and regulations.

As mentioned in the Theoretical Implications section, aviation systems, including aircraft technology, flight and maintenance operation manuals, work flow charts, checklists, safety procedures, and regulations, are heavily influenced by western culture (Helmreich & Merritt, 2001). Countries importing aircrafts operate their own aviation systems by simulating western systems, regardless of cultural conformity issues. However, designing culturally ergonomic aviation systems—including aircraft controls, operation procedures, safety procedures, and regulations—will help improve the safety performance of individuals (Cooper & Phillips, 2004). This study provides evidence that it is necessary to design aviation safety policies and regulations with greater consideration for cultural differences.

Policy modifications can be suggested based on the study findings. It was found that workplace pressures significantly increased error and violation behaviors. Employees reported that both anticipated obstacles and the difficulty of working with current safety procedures resulted in unsafe behaviors. Obstacles and difficulties should therefore be identified and removed to as great a degree as possible from current regulations and procedures. Work flow charts can be established for each task to determine the time required to perform procedures; they can also include the number of personnel required to perform tasks in a timely fashion in order to remove time and personnel deficit pressures.

The influence of the age variable on error behavior can be reduced by modifying task distribution, personnel recruitment, and health report requirement policies. The current hiring age

limit can be decreased to encourage the recruitment of younger employees. Regarding the task distribution policy, high-risk tasks can be assigned to younger employees rather than older ones. Employees older than a specific age can be assigned to low-risk tasks. Lastly, health report frequency can be increased as employee age increases.

Years of service had a significant relationship with violation behavior. The impact of collective culture can explain this relationship: Once social ties are developed, people are more likely to disregard safety rules and regulations. Several policy alterations can be suggested to minimize the negative influence of service years on violation behavior (violations consist of willful disregard for formal safety regulations and procedures). Anonymous violation report forms can be made available to encourage younger and newly recruited employees to inform management about witnessed violations. Such a policy would obligate experienced employees to obey safety regulations, as well as prevent the passing on of violation behavior to younger employees.

5.2.3 Managerial Implications

This study enables organizational management to formulate proactive solutions that reduce safety problems typically leading to accidents and injuries. While reactive solutions are put in place immediately after disasters and accidents, proactive solutions can be identified before accidents happen and applied to problematic areas. Subsequently, organization management can improve the safety level of the organization and the safety performance of

individuals based on safety culture observations. Several managerial implications manifest for the TNP Aviation Department based on the findings of this study.

Among the safety climate components, group norms was the most influential variable shaping individuals' intentions toward safety and violation behavior; after workplace pressures, it was the second most influential variable on error behavior. As mentioned in the Discussion section, the collectivist culture of Turkey places weight on the group norms variable. The second highest correlation was found between the group norms and management attitude components ($r = .53$, $p = .05$), suggesting that group norms can be influenced and manipulated via management attitude, thereby increasing groups' positive safety attitude. In addition, safety training programs can be applied through flight safety meetings to increase the safety perceptions of employee groups.

Workplace pressures, including anticipated obstacles and the difficulty of performing up to par with the additional burden of safety procedures, increase violation and error behavior in the organization, as assumed by TPB. Based on this finding, the TNP Aviation Department can identify pressures against and barriers to safety. Pilots, maintenance personnel, and office staff can be interviewed to specify the most influential pressures—among them lack of time, personnel, and safety instruments—exerted by management, peers, and individuals' own attitudes. Uncertainty regarding safety behavior is another pressure opposing safety. Management can examine the uncertainty regarding safety that emerges from the difficulty of observing safety regulations, inadequate information given to individuals, or the insufficient competence of individuals. Standard operation procedures, work flow charts, safety regulations,

and task definitions can be evaluated to observe the implementing difficulty. Likewise, individuals' information and competence regarding safety can be improved via specifically designed safety programs.

Contrary to initial assumptions, a positive significant relationship was found between the age and error variables, showing that older employees are more likely to make safety errors than younger ones. Error behavior had four indicators that observed decision, skill-based, and perceptual errors. Apart from the indicator observing skill-based error, age had a significant correlation with decision and perceptual errors. While decision errors arise from improper choices and poorly executed procedures, perceptual errors take place due to imperfect or inadequate information, misjudgments, and responding incorrectly to a diverse of visual and vestibular illusions (Shappell & Wiegmann, 2000; Wiegmann & Shappell, 2001; 2003). These findings suggest that aging erodes individuals' attention, concentration, and information, leading individuals to make incorrect decisions, improper judgments, and inaccurate responses. This study suggests that the management of the TNP Aviation Department can improve the safety level of the organization through an intervention program that refreshes older employees' familiarity with safety procedures. Contrary to the study's initial assumption, experienced older employees are no less fallible than younger employees—a significant finding, especially for the aviation industry, which is characterized by a high-risk environment requiring complete information, proper judgment, and full concentration. To address this issue, younger candidates can be preferred in recruiting new personnel. As well, the upper age limit for personnel can be decreased, especially for high-risk tasks. Additionally, health report frequency can be increased once personnel reach a certain age.

The relationship between years of service and violation behavior was found to be significant at the .05 level, with a standardized regression coefficient of .156. Contrary to the second hypothesis, TNP Aviation Department employees with more years of service are more likely to violate safety regulations and procedures than employees with fewer service years, despite the hypothesis that service years would be positively associated with safety behavior. Two of the five correlations between violation indicators and the years of service variable were significant. While the Violation4 indicator aimed to observe the extent to which individuals violate a part of a job to make a job easier, the Violation5 indicator was designed to observe individuals' confidence in their responsibilities for job safety. Increasing service years may give employees greater confidence, which could lead them to take shortcuts and engage in risk-taking behaviors. To reduce this effect and increase safety levels, management can prepare an intervention program for experienced members in order to increase risk awareness. An understanding of the hazards of extreme confidence in high-risk jobs can be disseminated among experienced members by discussing aviation accidents during flight safety meetings. Checklists can be modified to prevent shortcuts, because experienced employees often skip what they believe to be unnecessary items. The negative relationships between safety behavior, age, and service years revealed the importance of safety training and refreshing timeworn knowledge.

5.3 Conclusion

Tragic aircraft accidents fill the pages of aviation history. Aviation accidents cause significant hazards, loss of lives, and excessive cost, as well as damage in the public opinion. Contemporary human error models highlight a collectivist rather than an individual approach,

because human-related accidents do not happen in an isolated area but within an organizational context. In other words, organizational failures are more common factors in aviation accidents than individuals' failures. It is important to identify which organizational factors lead to failures, as well as which organizational features strengthen barriers against individual failures. This study aimed to trace the influence of organizational safety culture on individuals' safety behavior.

A comprehensive literature review of safety culture in aviation and a quantitative research design were established based on the theory of planned behavior (TPB). The data set was obtained through a survey of Turkish National Police Aviation Department members, who are influenced by two professional cultures. The contextual environments of aviation and law enforcement both affect police aviation departments. Safety culture studies have been conducted in high-risk industries, such as construction, transportation, nuclear power, and oil production, as well as in the aviation industry. Studying the organizational culture of the TNP Aviation Department has the potential to provide valuable guidelines for reducing human error and improving the safety reliability of high-risk organizations.

Confirmatory factor analysis with structural equation modeling was used to test the study hypotheses. According to the study findings, the safety climate of the organization, along with individual age and years of service, accounted for 65% of the variance in intention, 55% of the variance in violation behavior, and 68% of the variance in error behavior. No subgroup difference was observed in safety behavior variance. The theory of planned behavior is useful—with a minor cultural modification—in explaining individual safety behavior. Theoretical,

policy, and managerial implications were presented based on the study's findings. The purposes of the study included the isolation of factors affecting the development of recommendations for safety policy, safety procedure modifications, and strong safety culture design, because organizational culture should be considered during the constitution of safety norms and regulations. This study aimed to present empirical findings so that future researchers can develop strong organizational safety cultures to mitigate organizational and individual failures.

Safety culture observations enable an organization with multiple units to make valid comparisons among different locations, as well as to accurately evaluate safety intervention programs. The effectiveness of safety improvement programs can be evaluated via follow-up studies. This study took a snapshot of the safety climate of the TNP Aviation Department and the safety behaviors of its employees in the beginning of 2010.

5.4 Limitations

Several limitations should be noted for this investigation of the influence of organizational safety culture on individuals' safety behavior in the TNP Aviation Department. First, the data conducted for this study was obtained via survey questions that asked employees about their perceptions of safety culture, as well as their self-reported safety behaviors. It is within the realm of possibility that survey participants might have been reticent about making public their safety performance level, due to privacy concerns. Indeed, TNP Aviation Department employees had no reason to express their sincere attitudes and behaviors toward management, colleagues, and work pressures in the study. Individuals may have reported what

they felt were desirable answers rather than what they really believed when conducting these self-reported surveys. Self-reported safety behavior may have been subject to measurement bias in this study, because younger and less experienced employees may have avoided reporting their actual safety levels. Hence, the study's findings are dependent upon the sincere and honest answers of each respondent. The five-point Likert scale constitutes another limitation on the measurement part of the study because participants were asked to rank their beliefs, attitudes, and behaviors through self-report. Their personal responses represent their own opinions and can be expected to be one-sided. The study survey does not include questions addressing potential response bias, which refers to the reliability of participants' answers. Moreover, neither the "agree" nor the "disagree" option may have provided adequate response choices for the respondents.

Several arguments can be presented to overcome the survey-related limitations. First, survey questions did not include personal information, which permitted the protection of the respondents' identity. Survey participants were assured of their confidentiality and anonymity. Indeed, the method used to conduct the survey removed the possibility of any association between the responders' answers and their identity. Additionally, the researcher for this study is an active member of the TNP Aviation Department and is known by most of the members. The close relationship between the researcher and the respondent population established trust and encouraged them to participate in the study. Lastly, voluntary participation in the survey was declared to maximize the integrity of the responses. Negative response items were addressed to ensure that any systematic response bias was eliminated and corrected. Participants

systematically scoring in the same response category for every item were traced via the negative response items and excluded from the data.

Study variables are latent constructs; hence, they are measured by their indicators. Construct validity is an issue when measuring abstract concepts. Construct validity refers to the compliance between theoretical constructs and operationalized variables. It is important to consider whether the intended constructs are truly measured via measurement models. However, this study conducted confirmatory factor analysis to test and maximize the construct validity of the study. Moreover, the measurement models of latent constructs were adapted from Fogarty & Shaw's (2009) model, which has been tested by various studies (Hall, 2006; Baron, 2008). Hence, the construct validity of the study is not a significant threat for this study.

Most of the members of the TNP Aviation Department were included in the study. Therefore, the results of the study represent the perspectives of most members in the target organization. One of the major strengths of the study is that its findings reflect the perceptions of almost the entire population of the target organization. Working as a police helicopter pilot for six years in Istanbul, the largest city of Turkey, provided the study's researcher with a practitioner's point of view. The study's validity is significantly improved by the researcher's practitioner point of view.

Lastly, other factors may not have been considered when the theoretical and measurement models of the study were established. Although the human factors literature was widely studied, the study model may not have covered every dimension of the study variables.

These omitted factors may have an influence on the formation of organizational safety culture and individual safety behavior.

5.5 Future Research

Human error models for high-risk industries have recently highlighted a collectivist approach rather than an individualist one. It is widely believed that organizational failures more commonly cause aviation accidents than individual failures. Identifying the reasons for organizational failures is as important as establishing organizational features that strengthen the barriers against individual failures. Future researchers could design more complex studies by including national and professional cultures to identify organizational failures.

The formation of organizational safety culture is another important factor in strengthening barriers against accidents. The components of safety culture were limited in this study. In the future, researchers could perform studies to identify the differences within organizational subcultures and among organizations performing within the same high-risk industry. Examining the differences between industry sectors and between countries or cultures will address the negative aspects of organizational safety culture, as well as those processes that could strengthen the traditional safety culture.

The theory of planned behavior could be extended by including more components that predict safety behavior. Management attitude was included as a component of safety climate for this study because individuals consider managers when performing their jobs. Safety behavior was designed as a multidimensional construct that included violation and error behavior.

Violation and error behavior were designed based on the Human Factor Analysis and Classification System presented by Wiegmann & Shappell (2000; 2001; 2003).

National culture can be included in safety culture studies because it influences individuals' attitudes and behaviors. Cultural differences play an important role in safety climate components' relative bearing on safety behavior. While management was highlighted as the decisive safety climate component in Fogarty and Shaw's study, group norms were the most influential component in this study. Moreover, the assumed relationship between workplace pressures and intention was found to be not statistically significant in this study.

Among seven demographic and organizational variables, only the age and years of service variables were significant. The control variables having not statistically significant influence could be tested by more robust measurement levels. Although the city variable was intended to reflect organization size, size differences could be operationalized according to the number of flight mission performed or the units' number of flight hours. The task group variable could have been significant if the sample size had been large enough for multiple group analysis.

APPENDIX A - IRB APPROVAL

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Yildirim Uryan**

Date: **November 24, 2009**

Dear Researcher:

On 11/24/2009, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination
Project Title:	Organizational Determinants of Turkish Police Aviators' Safety Behavior
Investigator:	Yildirim Uryan
IRB Number:	SBE-09-06557
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Joseph Bielitzki, DVM, UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 11/24/2009 11:47:38 AM EST

Joanne Muratori

IRB Coordinator

APPENDIX B - RESEARCH PERMISSION LETTER

T.C.
İÇİŞLERİ BAKANLIĞI
Emniyet Genel Müdürlüğü
Dışilişkiler Daire Başkanlığı

Faks No : 00 90 312 466 90 22
Tel : 00 90 312 466 90 10
E-mail : disiliskilerdb@egm.gov.tr

SAYI : B.05.1.EGM.0.76.04.02 / 2939
TARİH : 07/06/2007
KONU :Genel Akademik Araştırma Onayı.
İLGİ :a) 23.03.2007 tarih ve B.05.1.EGM.0.76.04.02.(31004).871/1501 sayılı yazı.
b) 12.04.2007 tarih ve B.05.1.EGM.0.72.02.03-857-1480 sayılı yazı.

GÖNDEREN : Dr. Recep GÜLTEKİN
Dışilişkiler Dairesi Başkanı
1. Sınıf Emniyet Müdürü

GİDECEĞİ YER : Samih TEYMUR (ABD), İsa ÇİFTÇİ (ALM), Fatih YAMAÇ (FR), Fatih ÖZGÜL(İNG),Murat GÜLVER (BELÇİKA)

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İlgi (a) kayıtlı yazı ile mastır ve doktora yapmakta olan personelimizin eğitim gördüğü kendi alanlarıyla ilgili tez, akademik çalışma, makale gibi akademik araştırmalarda kullanmak üzere; Teşkilatımız bünyesindeki birimlerden gerekli istatistikî bilgilerin alınması ve bazı anket ve mülakat gibi akademik çalışmaların uygulanabilmesi için Emniyet Genel Müdürlüğü Makamından genel bir onay alınması Eğitim Daire Başkanlığı'ndan talep edilmiştir.

Adı geçen Daire Başkanlığı'ndan alınan ilgi (b) kayıtlı yazı ile "Yetiştirilmek Amacıyla Yurtdışına Gönderilecek Devlet Memurları Hakkındaki Yönetmelik" hükümleri çerçevesinde yurtdışındaki üniversitelere mastır ve doktora yapmak üzere gönderilen personelin Genel Müdürlüğümüze bağlı birimlerde ve taşra teşkilatında akademik çalışma yapma talebinde bulunması halinde tez çalışması yapabilmesi uygun görüldüğü belirtilmiş olup Genel Müdürlük Makam Onayın bir sureti ekte gönderilmiştir.

Bilgi ve gereğini rica ederim.

Dr. Recep GÜLTEKİN
Dışilişkiler Dairesi Başkanı
1. Sınıf Emniyet Müdürü

Ek:
İlgi (b) kayıtlı yazı. (2 sayfa)

ADRES: Emniyet Genel Müdürlüğü, Dışilişkiler Daire Başkanlığı
İlkadım Cad. 89/10 (S.Blok) 06100 Y.Ayrancı /ANKARA

APPENDIX C - TURKISH VERSION OF THE SURVEY INSTRUMENT

1. Bölüm: Personelin İş Güvenliği Kültürü Algısı

İş güvenliği, iş yerlerinde işin yapımı sırasında,sağlığa, işe ve işyerine zarar verebilecek kaza ve olumsuz şartlardan korunmak amacı ile konulmuş kural ve prosedürlere uygun çalışmak anlamına gelir.

1. Bölüm çalıştığınız yerde, sizin, iş arkadaşlarınızın ve yöneticilerinizin iş güvenliği hakkındaki tutumlarını, ve iş güvenliğini aksatan faktörleri nasıl algıladığınızı ölçmek amacıyla hazırlanmıştır.

Lütfen aşağıdaki her bir önermeyi dikkatle okuyun ve kendi görüşünüzü en iyi şekilde ifade eden seçeneği işaretleyin.

1.1. Bireyin Tutumu

1. İş güvenliği kuralları yaptığım işin daha güvenli olmasını sağlar.

Kesinlikle katılıyorum

Katılıyorum

Kısmen katılıyorum

Katılmıyorum

Kesinlikle katılmıyorum

2. İşimi yaparken gerekli güvenlik ekipmanlarını kullanırım.

3. İş arkadaşlarımın iş güvenliğine aykırı hareketlerine şahit olursam onları uyarırım.

4. Eğer iş arkadaşlarım ikazlarımı dikkate almazlarsa güvenli olmayan işlemleri amirime bildiririm.

5. İş performansımı düşürse bile iş güvenliği kurallarını takip etmeye çalışırım.

6. İş güvenliği olmayan şartlarda, herhangi bir kazayla karşılaşma ihtimalimiz yükselir.

7. Yaptığım iş için öngörülen güvenlik kuralları kazaları önlemek için gereklidir.

1.2. Grup Tutumu

8. Çalışanların çoğu çalışırken gereksiz yere risk alan personeli uyarırlar.

9. İş arkadaşlarım çoğu zaman iş güvenliği kurallarını gözardı etmemi telkin ederler.

10. İş arkadaşlarım muntazaman birbirlerinin iş güvenliği açıklarını kapatırlar.

11. Hemen hemen bütün çalışanlar işyerinin güvenlik politikasına aktif destek verirler.

12. İş arkadaşlarım iş güvenliği konusunda birbirlerine yardımcı olmayı isterler.

13. İş arkadaşlarım kazaya yol açabilecek olayları konuşup değerlendirme yapmaya önem verirler.

14. Çalıştığım yerde işler güvenlik kuralları ve prosedürlerine uygun bir şekilde yapılır.

15. İş arkadaşlarım, görev zamanlamasını etkilese bile iş güvenliğine uygun şekilde çalışırlar.

1.3. Yönetimin Tutumu

16. Yönetim çalışanları iş güvenliği konusunda ciddi biçimde destekler.

17. Yönetim iş güvenliği hakkında çalışanlara yeterli eğitimi sağlar.

18. Yönetim iş güvenliği ile ilgili bütün olayları üstlerine bildirmeleri için çalışanları teşvik eder.

19. Eğer yaptığım bir hatayı üstlerime bildirirsem yönetim bana destek olacaktir.

20. Yönetim, iş güvenliğine hassasiyet göstererek çalışabilmeleri için çalışanlara öncülük eder.

21. Yöneticilerimiz iş güvenliği ile ilgili konularda çalışanlarla sık sık gayri resmi müzakerelerde bulunur.

22. İşin güvenli bir şekilde yapılması görevin zamanında bitirilmesini aksatsa bile, yöneticilerimiz iş güvenliğini destekler.

23. Üstlerim, iş güvenliğinin geliştirilmesiyle ilgili görüşlerime değer verirler.

24. Üstlerim bazen iş güvenliği ihlallerini görmezden gelirler.

1.4. İsyerindeki Baskılar

25. İşyerimde, görevin tamamlanması, işin güvenli bir şekilde yapılmasından daha öncelikli görülür.

26. İşimi zamanında bitirebilmek için gerektiğinde işin bir kısmını kısa yoldan yaparım.

27. Bazen güvenli olarak yapabileceğimden daha fazla iş yapmam bekleniyor.

28. İş güvenliği kurallarının hepsini uygulayarak çalışmak zordur.

29. İşyerimde ağır iş yükünden dolayı kestirmeden yapılan işler ve riskli davranışlar yaygındır.

30. Bazı zamanlar işimin güvenli bir şekilde nasıl yapılabileceği konusunda emin olamıyorum.

31. İşim için gereken güvenlik ekipmanlarını işyerimden rahatlıkla tedarik edebilirim.

2. Bölüm: Personelin İş Güvenliği Performansı

2. bölüm iş güvenliğine yönelik çalışanın niyetini ve bunun ne ölçüde kişinin davranışlarına yansıdığını ölçmek üzere hazırlanmıştır.

Lütfen aşağıdaki her bir önermeyi dikkatle okuyun ve kendi görüşünüzü en iyi şekilde ifade eden seçeneği işaretleyin.

2.1. Niyet

32. Çalışmaya başlamadan önce yapacağım iş hakkında gerekli olan bütün güvenlik önlemlerinin alındığından emin olmaya çalışırım.

Kesinlikle katılıyorum

Katılıyorum

Kısmen katılıyorum

Katılmıyorum

Kesinlikle katılmıyorum

33. Çalışma ortamının güvenli olmadığını düşünürsem, çalışmaya başlamadan önce hangi ek güvenlik önlemlerinin alınabileceğini kontrol ederim.

34. İş güvenliği açısından bir risk gördügüm zaman bunu üstlerime bildiririm.

35. Eğer önerilen iş güvenliği prosedürlerinin fazla titiz veya etkisiz olduğunu düşünürsem, işi daha doğru olduğuna inandığım şekilde yaparım.

36. Verilen işi zamanında tamamlayabilmek için, gorevin gerektirdiginin otesinde is guvenligini etkileyecek riskleri de almaya hazırım.

37. İşi zamanında bitirebilmek icin risk almaktansa güvenli bir şekilde çalışmayı tercih ederim.

2.2. Ihlal Davranısı

38. Verilen bir iş için çalışırken iş güvenliği kurallarını genellikle dikkatle takip ettiğimi söyleyebilirim.

39. Aşina olduğum bir işi el kitabına veya yazılı prosedürlere bakmadan yaptığım olmuştur.

40. Bir işi zamanında bitirebilmek için uyulması gereken kuralları bilinçli olarak "esnettiğim" olmuştur.

41. Bir işi zamanında bitirebilmek için işi kolaylaştırmak adına prosedürlerin bir kısmını atladığım ve bunu kayıtlara geçirmediğim olmuştur.

42. İş güvenliği ile ilgili sorumluluklarımın bilincindeyim.

2.3. Hatalı Davranıs

43. İş güvenliği kural ve prosedürlerini takip etmek konusunda herhangi bir tereddütüm yoktur.

44. Hemen hemen tüm iş güvenliği kurallarını uygulama kapasitesine sahibim.

45. Güvenli hareket şeklinden emin olamadığım için bilmeden iş güvenliği kurallarını ihlal ettiğim olmuştur.

46. Seyrek olarak yapılan işlerde, eksik bilgiden dolayı iş güvenliğini riske sokan hatalar yaptığım olmuştur.

3.Bölüm: Personelin Kişisel ve Mesleki Bilgileri

3. bölüm kişinin demografik ve organizasyonel bilgilerini belirlemek için hazırlanmıştır.

Lütfen aşağıdaki her bir soruda kendi durumunuzu en iyi şekilde ifade eden seçeneği işaretleyin.

47. Göreviniz?

Pilot

Bakım ekibi (mühendis, teknisyen)

Destek ekibi (ATC, koruma, şoför, büro)

48. Hangi ilde görev yapıyorsunuz?

Antalya

Adana

İzmir

Diyarbakır

İstanbul

Ankara

49. Rütbeniz?

Polis memuru

Komiser yardımcısı – Başkomiser

Emniyet Amiri

Emniyet Müdürü

50. Yaşınız?

30 ve altı

30 - 40 arası

40 ve üstü

51. Eğitim durumunuz?

Lise

Yüksek okul

Üniversite

Mastır/Doktora

52. Kaç yıldır Havacılık Daire Başkanlığı veya bağli taşra şubelerinde çalışıyorsunuz?

5 yıl ve daha az

5 - 10 yıl arası

10 - 15 yıl arası

15 yıldan daha fazla

51. Toplam uçuş saatiniz? (Destek ekibi için cevap yok şıkkı uygundur)

Cevap yok

500 saat ve aşağısı

500 – 1000 arası

1001 – 1500 arası

1500 – 2500 arası

2500 saatten yukarısı

APPENDIX D - FREQUENCY AND PERCENTAGE DISTRIBUTION TABLES

Frequency and Percentage Distributions for Own Attitude Indicators

Indicators		Scale	Frequency	Percent
Own1	2	Disagree	11	5.2
Safety procedures make my job safer.	3	Somewhat agree	62	29.5
	4	Agree	67	31.9
	5	Strongly Agree	70	33.3
	Total		210	100.0
Own2	2	Disagree	3	1.4
I use required safety equipment while doing my job.	3	Somewhat agree	40	19.0
	4	Agree	92	43.8
	5	Strongly Agree	75	35.7
	Total		210	100.0
Own3	2	Disagree	6	2.9
I will say something if my peers take shortcuts.	3	Somewhat agree	35	16.7
	4	Agree	97	46.2
	5	Strongly Agree	72	34.3
	Total		210	100.0
Own4	2	Disagree	42	20.0
I will report a mistake if my concerns are overlooked.	3	Somewhat agree	84	40.0
	4	Agree	64	30.5
	5	Strongly Agree	19	9.0
	Total		210	100.0
Own5	2	Disagree	15	7.1
I follow work safety procedures even if this renders my job performance slower.	3	Somewhat agree	55	26.2
	4	Agree	80	38.1
	5	Strongly Agree	60	28.6
	Total		210	100.0
Own6	2	Disagree	10	4.8
Working in unsafe conditions increases the probability of suffering an injury.	3	Somewhat agree	38	18.1
	4	Agree	64	30.5
	5	Strongly Agree	98	46.7
	Total		210	100.0
Own7	2	Disagree	5	2.4
Safety procedures required by my job are not necessary to protect me from injury.	3	Somewhat agree	35	16.7
	4	Agree	74	35.2
	5	Strongly Agree	95	45.2
	Total		210	100.0

Frequency and Percentage Distributions for Group Norms Indicators				
Indicators		**Scale**	**Frequency**	**Percent**
Group1	2	Disagree	7	3.3
Most employees notify others when they observe them taking unnecessary risks.	3	Somewhat agree	52	24.8
	4	Agree	78	37.1
	5	Strongly Agree	73	34.8
	Total		210	100.0
Goup2	1	Strongly disagree	4	1.9
My co-workers often encourage me to disregard safety rules.	2	Disagree	19	9.0
	3	Somewhat agree	77	36.7
	4	Agree	95	45.2
	5	Strongly Agree	15	7.1
	Total		210	100.0
Group3	1	Strongly disagree	9	4.3
My co-workers regularly compliment each other for working safely.	2	Disagree	35	16.7
	3	Somewhat agree	64	30.5
	4	Agree	64	30.5
	5	Strongly Agree	38	18.1
	Total		210	100.0
Group4	1	Strongly disagree	1	0.5
Most of my co-workers actively support our safety program.	2	Disagree	12	5.7
	3	Somewhat agree	23	11.0
	4	Agree	97	46.2
	5	Strongly Agree	77	36.7
	Total		210	100.0
Group5	1	Strongly disagree	1	0.5
My co-workers are willing to coach each other about safety.	2	Disagree	12	5.7
	3	Somewhat agree	17	8.1
	4	Agree	92	43.8
	5	Strongly Agree	88	41.9
	Total		210	100.0
Group6	2	Disagree	8	3.8
Employees feel it is important to discuss/elaborate near miss incidents.	3	Somewhat agree	58	27.6
	4	Agree	99	47.1
	5	Strongly Agree	45	21.4
	Total		210	100.0

Group7	1	Strongly disagree	3	1.4
Where I work, tasks are performed in accordance with maintenance policy, processes, and procedures.	2	Disagree	27	12.9
	3	Somewhat agree	34	16.2
	4	Agree	64	30.5
	5	Strongly Agree	82	39.0
	Total		210	100.0
Group8	1	Strongly disagree	2	1.0
My co-workers follow safety concerns even if it adversely impacts the task deadline.	2	Disagree	15	7.1
	3	Somewhat agree	42	20.0
	4	Agree	78	37.1
	5	Strongly Agree	73	34.8
	Total		210	100.0

Frequency and Percentage Distributions for Management Attitude Indicators				
Indicators		**Scale**	**Frequency**	**Percent**
Management1	1	Strongly disagree	2	1
Management visibly demonstrates support (walks the talk) for employee safety.	2	Disagree	8	3.8
	3	Somewhat agree	31	14.8
	4	Agree	72	34.3
	5	Strongly Agree	97	46.2
	Total		210	100
Management2	1	Strongly disagree	3	1.4
Management provides adequate training and education for safety.	2	Disagree	21	10.0
	3	Somewhat agree	31	14.8
	4	Agree	86	41.0
	5	Strongly Agree	69	32.9
	Total		210	100
Management3	1	Strongly disagree	3	1.4
Management encourages employees to report all safety-related incidents.	2	Disagree	9	4.3
	3	Somewhat agree	42	20.0
	4	Agree	81	38.6
	5	Strongly Agree	75	35.7
	Total		210	100
Management4	1	Strongly disagree	6	2.9
Management would support me if I reported a mistake I had made.	2	Disagree	30	14.3
	3	Somewhat agree	51	24.3
	4	Agree	65	31.0
	5	Strongly Agree	58	27.6
	Total		210	100.0
Management5	1	Strongly disagree	6	2.9
Management demonstrates leadership by keeping people focused on safety.	2	Disagree	24	11.4
	3	Somewhat agree	23	11.0
	4	Agree	80	38.1
	5	Strongly Agree	77	36.7
	Total		210	100.0
Management6	1	Strongly disagree	9	4.3
Members of management often informally discuss safety issues with employees.	2	Disagree	27	12.9
	3	Somewhat agree	47	22.4
	4	Agree	70	33.3
	5	Strongly Agree	57	27.1

	Total		210	100.0
Management7	1	Strongly disagree	8	3.8
Management supports safety concerns when it adversely impacts the task deadline.	2	Disagree	25	11.9
	3	Somewhat agree	54	25.7
	4	Agree	61	29.0
	5	Strongly Agree	62	29.5
	Total		210	100.0
Management8	1	Strongly disagree	2	1.0
My immediate supervisor values my ideas about improving safety.	2	Disagree	20	9.5
	3	Somewhat agree	45	21.4
	4	Agree	70	33.3
	5	Strongly Agree	73	34.8
	Total		210	100.0
Management9	1	Strongly disagree	5	2.4
Our supervisors sometimes overlook unsafe practices.	2	Disagree	19	9.0
	3	Somewhat agree	59	28.1
	4	Agree	94	44.8
	5	Strongly Agree	33	15.7
	Total		210	100.0

Frequency and Percentage Distributions for Workplace Pressures Indicators				
Indicators		**Scale**	**Frequency**	**Percent**
Pressure1	1	Strongly disagree	27	12.9
Completing the task is given a higher priority than safety.	2	Disagree	82	39.0
	3	Somewhat agree	42	20.0
	4	Agree	33	15.7
	5	Strongly Agree	26	12.4
	Total		210	100
Pressure2	1	Strongly disagree	27	12.9
I take short cuts when I need to get the job done in a timely manner.	2	Disagree	76	36.2
	3	Somewhat agree	64	30.5
	4	Agree	33	15.7
	5	Strongly Agree	10	4.8
	Total		210	100
Pressure3	1	Strongly disagree	26	12.4
Sometimes I am expected to do more work than I can safely do.	2	Disagree	60	28.6
	3	Somewhat agree	46	21.9
	4	Agree	41	19.5
	5	Strongly Agree	37	17.6
	Total		210	100
Pressure4	1	Strongly disagree	40	19.0
It is difficult to do a job while following all of the safety rules.	2	Disagree	65	31.0
	3	Somewhat agree	33	15.7
	4	Agree	32	15.2
	5	Strongly Agree	40	19.0
	Total		210	100.0
Pressure5	1	Strongly disagree	63	30.0
Short cuts and risk taking are common due to the heavy workload.	2	Disagree	78	37.1
	3	Somewhat agree	43	20.5
	4	Agree	14	6.7
	5	Strongly Agree	12	5.7
	Total		210	100.0
Pressure6	1	Strongly disagree	36	17.1
Sometimes I am unsure how to do my job safely.	2	Disagree	84	40.0
	3	Somewhat agree	60	28.6

	4	Agree	19	9.0
	5	Strongly Agree	11	5.2
	Total		210	100.0

Pressure7	1	Strongly disagree	30	14.3
I can get safety equipment that is required for my job.	2	Disagree	75	35.7
	3	Somewhat agree	61	29.0
	4	Agree	40	19.0
	5	Strongly Agree	4	1.9
	Total		210	100.0

Frequency and Percentage Distributions for Intention Indicators

Indicators		Scale	Frequency	Percent
Intention1	1	Strongly disagree	3	1.4
Before starting a task I make sure that I know all the work safety procedures that are required for that task.	2	Disagree	5	2.4
	3	Somewhat agree	16	7.6
	4	Agree	86	41.0
	5	Strongly Agree	100	47.6
	Total		210	100
Intention2	1	Strongly disagree	1	0.5
If I thought an area was unsafe I would check to see what additional safety measures were needed before I entered.	2	Disagree	28	13.3
	3	Somewhat agree	75	35.7
	4	Agree	84	40.0
	5	Strongly Agree	22	10.5
	Total		210	100
Intention3	1	Strongly disagree	1	o.5
I would report a work safety hazard if I was aware of one.	2	Disagree	7	3.3
	3	Somewhat agree	30	14.3
	4	Agree	87	41.4
	5	Strongly Agree	85	40.5
	Total		210	100
Intention4	1	Strongly disagree	48	22.9
I am prepared to undertake a task in a better way if I consider the approved procedure or process to be overly cautious or inefficient.	2	Disagree	32	15.2
	3	Somewhat agree	54	25.7
	4	Agree	52	24.8
	5	Strongly Agree	24	11.4
	Total		210	100.0
Intention5	2	Disagree	17	8.1
I am prepared to take risks, other than those inherent in my job, to get a task done.	3	Somewhat agree	77	36.7
	4	Agree	86	41.0
	5	Strongly Agree	30	14.3
	Total		210	100.0
Intention6	1	Strongly disagree	4	1.9
In my job there is a tradeoff between getting the task completed and doing it by the book.	2	Disagree	14	6.7
	3	Somewhat agree	29	13.8
	4	Agree	64	30.5
	5	Strongly Agree	99	47.1
	Total		210	100.0

Frequency and Percentage Distributions for Violation Behavior Indicators				
Indicators		**Scale**	**Frequency**	**Percent**
Violation1 When given a task, I ensure that approved procedures are followed.	1	Strongly disagree	48	22.9
	2	Disagree	78	37.1
	3	Somewhat agree	59	28.1
	4	Agree	15	7.1
	5	Strongly Agree	10	4.8
	Total		210	100
Violation2 I have performed a familiar task without referring to the maintenance manual or other approved documentation.	1	Strongly disagree	35	16.7
	2	Disagree	72	34.3
	3	Somewhat agree	70	33.3
	4	Agree	27	12.9
	5	Strongly Agree	6	2.9
	Total		210	100
Violation3 I have deliberately 'bent" formal procedures in order to complete a task on time.	1	Strongly disagree	29	13.8
	2	Disagree	73	34.8
	3	Somewhat agree	63	30.0
	4	Agree	34	16.2
	5	Strongly Agree	11	5.2
	Total		210	100
Violation4 I have temporarily disconnected or removed a part to make a job easier, but not documented the disconnection/removal.	1	Strongly disagree	21	10.0
	2	Disagree	67	31.9
	3	Somewhat agree	84	40.0
	4	Agree	30	14.3
	5	Strongly Agree	8	3.8
	Total		210	100.0
Violation5 I am clear about my responsibilities for job safety.	1	Strongly disagree	30	14.3
	2	Disagree	64	30.5
	3	Somewhat agree	68	32.4
	4	Agree	38	18.1
	5	Strongly Agree	10	4.8
	Total		210	100.0

Frequency and Percentage Distributions for Error Behavior Indicators				
Indicators		**Scale**	**Frequency**	**Percent**
Error1	1	Strongly disagree	79	37.6
It is clear for me how to follow the safety regulations and procedures.	2	Disagree	98	46.7
	3	Somewhat agree	20	9.5
	4	Agree	12	5.7
	5	Strongly Agree	1	0.5
	Total		210	100
Error2	1	Strongly disagree	84	40.0
I am capable to follow all safety rules.	2	Disagree	93	44.3
	3	Somewhat agree	27	12.9
	4	Agree	6	2.9
	Total		210	100
Error3	1	Strongly disagree	84	40.0
I have made safety errors because of not knowing how to work safely.	2	Disagree	98	46.7
	3	Somewhat agree	20	9.5
	4	Agree	6	2.9
	5	Strongly Agree	2	1.0
	Total		210	100
Error4	1	Strongly disagree	77	36.7
I have made errors creating risk to safety throughout rarely performed works.	2	Disagree	99	47.1
	3	Somewhat agree	22	10.5
	4	Agree	10	4.8
	5	Strongly Agree	2	1.0
	Total		210	100.0

APPENDIX E - CORRELATION MATRIX TABLES

Correlations between Own Attitude Indicators and Control Variables

		Group	City	Rank	Age	Edu	Year	Flight
Own1	Gamma	-.062	.042	-.062	.037	.006	.138	.074
	Sig. (2-tailed)	.485	.586	.505	.704	.943	.088	.336
	N	210	210	210	210	210	210	210
Own2	Gamma	-.094	-.002	-.046	.190	.063	.082	-.024
	Sig. (2-tailed)	.319	0.98	0.654	.058	.506	.334	.783
	N	210	210	210	210	210	210	210
Own3	Gamma	-.227*	-.116	-0.182	.116	-.153	.030	-.152
	Sig. (2-tailed)	.014	.165	.066	.243	.095	.728	.064
	N	210	210	210	210	210	210	210
Own4	Gamma	.106	.046	.084	.037	.089	.202*	.120
	Sig. (2-tailed)	.228	.553	.375	.707	.316	.012	.133
	N	210	210	210	210	210	210	210
Own5	Gamma	-.117	-.090	-.169	.118	0	-.027	-.039
	Sig. (2-tailed)	.170	.257	.069	.216	1	.734	.608
	N	210	210	210	210	210	210	210
Own6	Gamma	-.156	-.101	-.120	.077	-.053	.034	-.021
	Sig. (2-tailed)	.103	.192	.225	.426	.578	.676	.803
	N	210	210	210	210	210	210	210
Own7	Gamma	.017	-.115	-.018	-.025	-.015	.108	.076
	Sig. (2-tailed)	.858	.172	.859	.803	.878	.195	.332
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations between Group Norms Indicators and Control Variables

		Group	City	Rank	Age	Edu	Year	Flight
Group1	Gamma	-.120	-.128	-.158	.034	-.134	-.035	-.046
	Sig. (2-tailed)	.212	.103	.081	.743	.145	.682	.544
	N	210	210	210	210	210	210	210
Group2	Gamma	-.095	-.375**	-.114	.127	.017	.012	.006
	Sig. (2-tailed)	.321	0	.257	.210	.845	.885	.945
	N	210	210	210	210	210	210	210
Group3	Gamma	.056	.003	.115	-.018	.111	-.128	.009
	Sig. (2-tailed)	.490	.965	.180	.841	.143	.086	.902
	N	210	210	210	210	210	210	210
Group4	Gamma	-.230*	-.267**	-.317**	-.036	-.156	-.135	-.116
	Sig. (2-tailed)	.013	.001	.001	.715	.070	.105	.155
	N	210	210	210	210	210	210	210
Group5	Gamma	-.147	-.165	-.162	-.004	-.116	-.077	-.112
	Sig. (2-tailed)	.129	.055	.107	.968	.200	.361	.166
	N	210	210	210	210	210	210	210
Group6	Gamma	.039	-.281**	.015	-.021	-.022	-.014	.065
	Sig. (2-tailed)	.686	0	.884	.820	.809	.864	.441
	N	210	210	210	210	210	210	210
Group7	Gamma	-.007	-.158*	-.034	-.013	-.043	-.111	-.008
	Sig. (2-tailed)	.936	.031	.717	.887	.624	.141	.914
	N	210	210	210	210	210	210	210
Group8	Gamma	-.189*	-.192**	-.157	-.043	-.161	-.041	-.081
	Sig. (2-tailed)	.038	.009	.090	.652	.073	.602	.283
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations between Management Attitude Indicators and Control Variables

		Group	City	Rank	Age	Edu	Year	Flight
Mng1	Gamma	.013	-.179*	.113	-.035	.083	-.031	-.130
	Sig. (2-tailed)	.890	.035	.249	.733	.351	.693	.123
	N	210	210	210	210	210	210	210
Mng2	Gamma	.020	-.183*	.037	-.173	.116	-.082	-.106
	Sig. (2-tailed)	.816	.014	.693	.062	.169	.316	.172
	N	210	210	210	210	210	210	210
Mng3	Gamma	-.028	-.242**	-.015	-.126	-.112	-.072	-.119
	Sig. (2-tailed)	.753	.001	.869	.184	.178	.397	.143
	N	210	210	210	210	210	210	210
Mng4	Gamma	-.023	-.209**	.006	.024	-.071	.128	.033
	Sig. (2-tailed)	.791	.003	.943	.799	.393	.096	.659
	N	210	210	210	210	210	210	210
Mng5	Gamma	.048	-.213**	.137	-.140	.135	-.004	-.019
	Sig. (2-tailed)	.586	.004	.137	.135	.123	.958	.810
	N	210	210	210	210	210	210	210
Mng6	Gamma	.062	-.091	.108	-.084	.031	-.167*	-.115
	Sig. (2-tailed)	.469	.196	.226	.351	.704	.033	.139
	N	210	210	210	210	210	210	210
Mng7	Gamma	.007	-.121	.100	.032	-.057	.044	.054
	Sig. (2-tailed)	.937	.074	.251	.723	.466	.581	.467
	N	210	210	210	210	210	210	210
Mng8	Gamma	.301**	-.080	.324**	-.199*	.234**	.009	.120
	Sig. (2-tailed)	.001	.269	.001	.032	.005	.900	.130
	N	210	210	210	210	210	210	210
Mng9	Gamma	.049	.020	-.005	.114	-.086	.109	.046
	Sig. (2-tailed)	.591	.786	.956	.206	.308	.161	.572
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations between Workplace Pressures Indicators and Control Variables

		Group	City	Rank	Age	Edu	Year	Flight
Press1	Gamma	-.329**	-.024	-.304**	.044	-.118	-.085	-.237**
	Sig. (2-tailed)	.000	.733	.000	.624	.151	.256	.002
	N	210	210	210	210	210	210	210
Press2	Gamma	-.114	.043	-.027	.101	-.070	-.022	-.146*
	Sig. (2-tailed)	.211	.554	.778	.255	.436	.783	.049
	N	210	210	210	210	210	210	210
Press3	Gamma	-.177*	.091	-.123	.186**	-.084*	.042	-.088
	Sig. (2-tailed)	.037	.185	.143	.029	.290	.550	.203
	N	210	210	210	210	210	210	210
Press4	Gamma	-.066	.125	-.048	.091	-.069	-.059	-.013
	Sig. (2-tailed)	.409	.055	.577	.259	.372	.399	.862
	N	210	210	210	210	210	210	210
Press5	Gamma	-.235**	.185*	-.22**	.243**	-.174*	.069	-.069
	Sig. (2-tailed)	.006	.012	.010	.007	.035	.396	.390
	N	210	210	210	210	210	210	210
Press6	Gamma	-.199*	.258**	-.141	.141	-.134	.017	-.062
	Sig. (2-tailed)	.023	.000	.131	.130	.106	.818	.433
	N	210	210	210	210	210	210	210
Press7	Gamma	-.126	.086	-.087	.117	-.086	.098	-.076
	Sig. (2-tailed)	.150	.217	.333	.196	.314	.205	.330
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations between Intention Indicators and Control Variables

		Group	City	Rank	Age	Edu	Year	Flight
Intent1	Gamma	-.059	-.235**	-.113	-.085	-.016	-.041	-.078
	Sig. (2-tailed)	.556	.007	.276	.405	.874	.647	.380
	N	210	210	210	210	210	210	210
Intent2	Gamma	.047	-.256**	-.036	-.082	-.062	.021	.039
	Sig. (2-tailed)	.615	.001	.707	.407	.493	.792	.609
	N	210	210	210	210	210	210	210
Intent3	Gamma	.048	-.110	.083	-.106	.067	-.075	-.037
	Sig. (2-tailed)	.618	.173	.417	.299	.475	.380	.662
	N	210	210	210	210	210	210	210
Intent4	Gamma	.386**	-.091	.291**	.109	.202**	.219**	.305**
	Sig. (2-tailed)	.000	.189	.000	.214	.008	.002	.000
	N	210	210	210	210	210	210	210
Intent5	Gamma	.092	-.207**	-.039	.039	.063	.097	.157*
	Sig. (2-tailed)	.323	.010	.969	.690	.481	.240	.046
	N	210	210	210	210	210	210	210
Intent6	Gamma	-.238**	-.314**	-.248**	.042	-.199*	-.048	-.098
	Sig. (2-tailed)	.010	.000	.007	.675	.031	.552	.228
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations between Violation Behavior Indicators and Control Variables

		Group	City	Rank	Age	Edu	Year	Flight
VioB1	Gamma	.001	.080	-.048	.118	-.073	.148	.128
	Sig. (2-tailed)	.993	.290	.601	.210	.423	.056	.105
	N	210	210	210	210	210	210	210
VioB2	Gamma	-.102	.211**	-.164	.111	-.016	-.023	-.072
	Sig. (2-tailed)	.224	.003	.071	.222	.852	.766	.377
	N	210	210	210	210	210	210	210
VioB3	Gamma	-.118	.110	-.158	.170	-.035	.078	-.017
	Sig. (2-tailed)	.158	.128	.071	.054	.668	.283	.829
	N	210	210	210	210	210	210	210
VioB4	Gamma	.056	.155*	.003	.150	-.056	.253**	.130
	Sig. (2-tailed)	.534	.047	.975	.111	.524	.001	.084
	N	210	210	210	210	210	210	210
VioB5	Gamma	.007	.004	-.048	.162	-.014	.144*	.118
	Sig. (2-tailed)	.938	.952	.596	.069	.875	.044	.114
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations between Error Behavior Indicators and Control Variables								
		Group	**City**	**Rank**	**Age**	**Edu**	**Year**	**Flight**
ErrB1	Gamma	.016	.335**	-.098	.244*	-.050	.317**	.196*
	Sig. (2-tailed)	.861	.000	.328	.019	.599	.000	.017
	N	210	210	210	210	210	210	210
ErrB2	Gamma	-.044	.327**	.009	.185	-.104	.098	-.080
	Sig. (2-tailed)	.648	.000	.932	.066	.274	.265	.380
	N	210	210	210	210	210	210	210
ErrB3	Gamma	-.073	.207*	-.030	.203	-.181	.094	-.036
	Sig. (2-tailed)	.461	.012	.778	.052	.054	.292	.683
	N	210	210	210	210	210	210	210
ErrB4	Gamma	-.129	.164*	-.087	.295**	-.023	.129	-.048
	Sig. (2-tailed)	.171	.048	.376	.002	.806	.122	.583
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Own Attitude Indicators

		Own1	Own2	Own3	Own4	Own5	Own6
Own1	Spearman's rho Correlation	1					
	Sig. (2-tailed)						
	N	210					
Own2	Spearman's rho Correlation	.523**	1				
	Sig. (2-tailed)	.000					
	N	210	210				
Own3	Spearman's rho Correlation	.319**	.350**	1			
	Sig. (2-tailed)	.000	.000				
	N	210	210	210			
Own4	Spearman's rho Correlation	.273**	.131	.140*	1		
	Sig. (2-tailed)	.000	.057	.043			
	N	210	210	210	210		
Own5	Spearman's rho Correlation	.461**	.454**	.362**	0.155*	1	
	Sig. (2-tailed)	.000	.000	.000	.025		
	N	210	210	210	210	210	
Own6	Spearman's rho Correlation	.428**	.432**	.432**	.027	.297**	1
	Sig. (2-tailed)	.000	.000	.000	.693	.000	
	N	210	210	210	210	210	210
Own7	Spearman's rho Correlation	.433**	.400**	.493**	.067	.290**	.563**
	Sig. (2-tailed)	.000	.000	.000	.335	.000	.000
	N	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Group Norms Indicators

		Group1	Group2	Group3	Group4	Group5	Group6	Group7
Group1	Spearman's rho C	1						
	Sig. (2-tailed)							
	N	210						
Group2	Spearman's rho C	.044	1					
	Sig. (2-tailed)	.531						
	N	210	210					
Group3	Spearman's rho C	.045	.130	1				
	Sig. (2-tailed)	.514	.060					
	N	210	210	210				
Group4	Spearman's rho C	.318**	.153**	.058	1			
	Sig. (2-tailed)	.000	.026	.402				
	N	210	210	210	210			
Group5	Spearman's rho C	.464**	.160*	.112	.418**	1		
	Sig. (2-tailed)	.000	.020	.106	.000			
	N	210	210	210	210	210		
Group6	Spearman's rho C	.321**	.217**	.111	.175*	.309**	1	
	Sig. (2-tailed)	.000	.002	.109	.011	.000		
	N	210	210	210	210	210	210	
Group7	Spearman's rho C	.252**	.204**	.135	.244**	.396**	.425**	1
	Sig. (2-tailed)	.000	.003	.050	.000	.000	.000	
	N	210	210	210	210	210	210	210
Group8	Spearman's rho C	.386**	.092	-.025	.293**	.212**	.351**	.470**
	Sig. (2-tailed)	.000	.184	.723	.000	.002	.000	.000
	N	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Management Attitude Indicators

		Mng1	Mng2	Mng3	Mng4	Mng5	Mng6	Mng7	Mng8
Mng1	Spearman's rho C	1							
	Sig. (2-tailed)								
	N	210							
Mng2	Spearman's rho C	.297**	1						
	Sig. (2-tailed)	.000							
	N	210	210						
Mng3	Spearman's rho C	.368**	.340**	1					
	Sig. (2-tailed)	.000	.000						
	N	210	210	210					
Mng4	Spearman's rho C	.360**	.344**	.448**	1				
	Sig. (2-tailed)	.000	.000	.000					
	N	210	210	210	210				
Mng5	Spearman's rho C	.535**	.434**	.366**	.435**	1			
	Sig. (2-tailed)	.000	.000	.000	.000				
	N	210	210	210	210	210			
Mng6	Spearman's rho C	.309**	.265**	.372**	.302**	.317**	1		
	Sig. (2-tailed)	.000	.000	.000	.000	.000			
	N	210	210	210	210	210	210		
Mng7	Spearman's rho C	.417**	.346**	.370**	.322**	.452**	.374**	1	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		
	N	210	210	210	210	210	210	210	
Mng8	Spearman's rho C	.351**	.315**	.327**	.295**	.354**	.256**	.426**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	
	N	210	210	210	210	210	210	210	210
Mng9	Spearman's rho C	-.018	.010	-.021	.013	-.043	-.146*	-.082	.040
	Sig. (2-tailed)	.793	.883	.763	.853	.534	.034	.238	.565
	N	210	210	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Workplace Pressures Indicators							
		Press1	**Press2**	**Press3**	**Press4**	**Press5**	**Press6**
Press1	Spearman's rho Correlation	1					
	Sig. (2-tailed)						
	N	210					
Press2	Spearman's rho Correlation	.437**	1				
	Sig. (2-tailed)	.000					
	N	210	210				
Press3	Spearman's rho Correlation	.286**	.367**	1			
	Sig. (2-tailed)	.000	.000				
	N	210	210	210			
Press4	Spearman's rho Correlation	.211**	.440**	.328**	1		
	Sig. (2-tailed)	.002	.000	.000			
	N	210	210	210	210		
Press5	Spearman's rho Correlation	.319**	.319**	.342**	.384**	1	
	Sig. (2-tailed)	.000	.000	.000	.000		
	N	210	210	210	210	210	
Press6	Spearman's rho Correlation	-.033	.167*	.125	.162*	.159	1
	Sig. (2-tailed)	.633	.015	.071	.019	.021	
	N	210	210	210	210	210	210
Press7	Spearman's rho Correlation	.357**	.533**	.502**	.538**	.398**	.239**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
	N	210	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Intention Indicators

		Intent1	Intent2	Intent3	Intent4	Intent5
Intent1	Spearman's rho Correlation	1				
	Sig. (2-tailed)					
	N	210				
Intent2	Spearman's rho Correlation	.429**	1			
	Sig. (2-tailed)	.000				
	N	210	210			
Intent3	Spearman's rho Correlation	.389**	.234**	1		
	Sig. (2-tailed)	.000	.001			
	N	210	210	210		
Intent4	Spearman's rho Correlation	.010	.171*	.091	1	
	Sig. (2-tailed)	.886	.013	.191		
	N	210	210	210	210	
Intent5	Spearman's rho Correlation	.239**	.476**	.329**	.163*	1
	Sig. (2-tailed)	.000	.000	.000	.018	
	N	210	210	210	210	210
Intent6	Spearman's rho Correlation	.353**	.340**	.417**	.026	.330**
	Sig. (2-tailed)	.000	.000	.000	.706	.000
	N	210	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Violation Behavior Indicators

		VioB1	VioB2	VioB3	VioB4
VioB1	Spearman's rho Correlation	1			
	Sig. (2-tailed)				
	N	210			
VioB2	Spearman's rho Correlation	0.465**	1		
	Sig. (2-tailed)	.000			
	N	210	210		
VioB3	Spearman's rho Correlation	.393**	.506**	1	
	Sig. (2-tailed)	.000	.000		
	N	210	210	210	
VioB4	Spearman's rho Correlation	.429**	.436**	.461**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	210	210	210	210
VioB5	Spearman's rho Correlation	.431**	.471**	.476**	.520**
	Sig. (2-tailed)	.000	.000	.000	.000
	N	210	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

Correlations of Error Behavior Indicators				
		ErrB1	**ErrB2**	**ErrB3**
ErrB1	Spearman's rho Correlation	1		
	Sig. (2-tailed)	.		
	N	210		
ErrB2	Spearman's rho Correlation	.291**	1	
	Sig. (2-tailed)	.000	.	
	N	210	210	
ErrB3	Spearman's rho Correlation	.315**	.298**	1
	Sig. (2-tailed)	.000	.000	.
	N	210	210	210
ErrB4	Spearman's rho Correlation	.390**	.458**	.166**
	Sig. (2-tailed)	.000	.000	.016
	N	210	210	210

**. Correlation is significant at the 0.01 level (2-tailed).

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

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