ASSESSING SAFETY CULTURE OF PROFESSIONAL PILOTS WITHIN SELECTED SOUTH AFRICAN BASED AVIATION ORGANISATIONS

By

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ABSTRACT

The aviation industry is one of many industries which is known to be a high-risk industry. Although it is a high risk industry, little research has been conducted within the industry especially with regards to safety culture. Safety culture is pivotal within the aviation industry as it reduces the potential to large scale disasters. While airlines are deemed to be highly reliable, when an accident occurs the cause usually tends to be human error. The aim of this study was to assess safety culture of professional pilots within selected South African based aviation organisations.

This study utilized a safety culture quantitative survey instrument in order to collect data from pilots at selected South African based aviation organisations. The survey consisted of five themes (organisational commitment, management involvement, accountability systems, reporting systems and pilot empowerment). The pilots were required to respond to 49-item statements on a 5 point-likert scale, by only choosing one answer per statement.

The results indicated that a majority of the participants had responded positively towards the items which represented a healthy safety culture within the selected South African based aviation organisations. Furthermore, a highly positive correlation exists between the themes of organisational commitment and management involvement. Multiple regression analysis showed there is an association between the five themes of safety culture with organisational commitment being a dependent variable. No significant difference was found between biographical information (such as rank, years of experience and flying hours), along with either the themes of organisational commitment or pilot empowerment.

DECLARATION

I declare that *Assessing Safety Culture of Professional Pilots within Selected South African Based Aviation Organisations* is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Amirah Fatoma Gadija Davids Date: June 2016

Signature: .....

DEDICATION

To my parents: Mogamad Phaldie Davids & Fatoma Doutie, I am honoured to have you both as my parents. Thank you for your unconditional love, guidance and constantly encouraging me to pursue my studies.

To my siblings: Luqman Davids and Saarah Davids, thank you for your endless love, assistance and encouragement.

"*Once you have tasted flight, you will forever walk the earth with your eyes turned skyward, for there you have been, and there you will always long to return*"- Leonardo da Vinci

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CHAPTER 1: Introduction and Overview

1.1 Introduction

Air travel has become a major source of transportation to get from one destination to the next, within a short period of time. According to the Director General and CEO of the International Air Transport Association (IATA), safety is of paramount importance within the aviation industry (Tyler, 2015). Engle (2002) describes the growth of air travel as being an exponential one and this is evident from the population growth. While the aviation industry is constantly increasing, it is undoubtedly a high- reliability industry (ECRI Institute, 2009).

The concept of safety culture in the aviation industry is pivotal as it reduces the potential for large scale disasters. According to Hassett (2011) airlines are deemed to be High Reliability Organisations (HRO) whereby accidents are infrequent. However, when accidents occur it often includes intensive investigations into the causal factors of the accidents which regularly tend to be human error (Helmreich, 2000). Although a number of studies have been performed in high-risk industries, to define and assess the safety culture, very few have been conducted and documented within the aviation industry (Von Thaden, Wiegmann, Mitchell, Sharma, & Zhang, 2003; Wiegmann, Zhang, Von Thaden, Sharma & Gibbons, 2004). Of the few studies that were conducted the results indicates variability with regards to the fundamental nature of the safety culture concept.

1.2 Rationale for Research

Most aviation accidents cause a vast number of fatalities and usually lead to the rapid response of federal agencies investigating the accident (LaPoint, 2012). One of the elements responsible for making air travel possible is pilots. According to Cooper (2002), "Safety Culture" has become an increased interest for many industries across the globe. This is because safety culture is associated with reducing the risk of potential large scale disasters as well as other risk associated with routine tasks. The Federal Aviation Administration (FAA) thrives on Safety as the association is based on providing the most efficient aerospace system in the world (Federal Aviation Administration, n.d).

While the commercial aircrafts only requires pilots' interaction during certain periods of the flight time, the human factor is a major contributor that affects safety of the journey (Hopkins, 2002). Hopkins (2002), further mentions 95% of aviation accidents are due to human error. The South African Civil Aviations Authority (SACAA) (n.d) reiterates this and provides additional reasons for accidents occurring (SACAA, n.d.) (SACAA, n.d.). Those reasons include procedures not being followed, pilots disregarding how they get to their destinations, the pilots bad habits as well as their attitudes, just to name a few. Even though the human factor is a major issue affecting safety, government safety organisations and unions focus more on equipment which pilots uses rather than pilot attitudes and practices. This is done without realizing that altering behaviour is more difficult than altering equipment (Hopkins, 2002).

Although commercial pilots have a greater responsibility for human life, and have more structure, set rules, and higher Safety Operating Procedures (SOPs), they experience the most job satisfaction in comparison to aircraft pilots in other disciplines (Hoole & Vermeulen, 2003). The aviation safety standards of South Africa, is compared to that of the best in the world and above average in Africa (O'Sullivan, 2008). The last time a South African commercial airline faced an accident, which was deemed to be a tragedy, was in 1987 (South African Airways Museum, n.d; Selvon, 2012). All 159 individuals who were on board flight 295, which crashed into the Indian Ocean off Mauritius, lost their lives (Selvon, 2012)..

Despite the aviation industry being in the headlines throughout the year of 2014, according to the numbers generated, 2014 was deemed to be the safest year within the industry (Tyler, 2015). Tyler (2015) further mentioned of the 400 airlines IATA has on their registrar, there was only one major jet accident to every 4.4 million flights during the year and no losses of jets occurred in Africa and North Asia.

The importance of safety culture and the management of safety aspects link closely to the practice of Industrial and Organisational (I-O) Psychology not only within the aviation industry but also within organisations in general. According to Bergh and Theron (2009), I-O Psychology studies behaviours along with processes involved in the employee and organisational functioning. The prevention of work-related injuries and illness, which forms part of I-O Psychology processes, is imperative to employees, the industry as well as the public the organisations serve (Smith & Wadsworth, 2009).Although Nel, Werner, Poisat, Sono, Du Plesis,

Ngalo, Van Hoek and Botha (2011) indicated the 21st century demands employers to be more proactive when it comes to managing health and safety matters. Every action or attitude of the employees contributes to their safety practices (Farrington-Darby, Pickup, & Wilson, 2005) . The incorrect practices and attitudes of pilots towards safety, could lead to impaired actions, which in turn could lead to disastrous incident or accidents.

In order to reduce incidents and accidents, the pilots' attitudes towards safety, specifically safety culture, should be identified. Once these factors are identified and assessed, aviation organisations together with the assistance of the pilots and guidance from the regulatory authorities, such as International Civil Aviation Organisation (ICAO), FAA and IATA should synergize in order to improve the overall attitudes of pilots towards safety culture. In turn, this could reduce the level of accidents and incidents within the aviation industry.

1.3 Problem Statement

Reiterating the importance of safety within a high-risk industry, such as the aviation industry (Tyler, 2015), little research has been conducted within the aviation industry on the matter (Von Thaden, Wiegmann, Mitchell, Sharma, & Zhang, 2003; Wiegmann, Zhang, Von Thaden, Sharma & Gibbons, 2004). With the SACAA providing annual reports of civil aviation accidents and incidents within South Africa on their webpage, this indicates that accidents and incidents are an ongoing occurrence. However, little to no research has been conducted within I-O Psychology in the South African aviation industry among professional pilots with regards to safety culture. Hence, this study attempts to determine the impact safety culture has on professional pilots within the South African aviation industry.

1. 4 Aims and Objectives

The main aim of this study is to assess factors contributing to the safety culture of professional pilots within selected South African based aviation organisations. The study would further provide recommendations on how the safety culture within the South African aviation industry could be improved in order for safety practices to be improved.

1.5 Hypotheses

Hypotheses are testable statements that are developed at the beginning of a study and tested in the study to determine whether the statement was true or not (Sekaran, 2002). These statements contain two or more variables, of which there is one dependent variable and at least one independent variable.

H1: There is a statistically significant relationship between the years of experience pilots have and pilot empowerment.

H2: A statistically significant relationship exists between management involvement and organisational commitment.

H3: There is a statistically significant relationship between the rank of the professional pilot, organisational commitment, and pilot empowerment.

H4: Reporting systems, accountability systems, pilot empowerment and management involvement explain a significant proportion of the variance in organisational commitment, as part of safety culture amongst pilots.

1.6 Structure of the Study

The structure for this proposed research, assessing safety culture of professional pilots within selected South African based aviation organisations, is as follows;

Chapter 1 provides the introduction of the thesis along with motivation for the study and background on the topic. It also includes the aims and objectives, and hypotheses of the study.

Chapter 2 consists of definitions and concepts with regards to safety culture among pilots within the aviation industry. Literature with regards to safety culture, specifically in the aviation industry, is also examined.

Chapter 3 presents a detailed description of the study's research methodology. The research methodology includes the population, sampling procedure, method of data collection as well as statistical analysis techniques used.

Chapter 4 provides a report on the results generated from data collected.

Chapter 5 consist of conclusions drawn from the results. Additionally, it includes limitations of the study as well as recommendations based on the findings of the data revelation.

1.7 Conclusion

The aim of this chapter was to present a detailed overview of the research which will be conducted. This was done by providing an introduction of the topic along with the background and motivation for the study. The aims and objectives were also looked at in order to provide the purpose of the research. Furthermore, the hypotheses were stated and an overview of the thesis chapters was provided.

CHAPTER 2: Literature Review

2.1 Introduction

The purpose of this literature review is to identify and discuss key concepts relating to safety culture within the aviation industry. Investigations with regards to the aspect of human error and factors relating to human error are also discussed. Developed models with regards to the concept of safety management and safety culture are identified to enable the researcher and reader to better understand the concepts of safety culture amongst pilots.

2.2 Safety

2.2.1 Defining Safety in the Aviation Industry

With regards to civil aviation, Fisher (2010) indicates Transport Canada's new mission of safety as "the condition to which risks are managed to acceptable levels". Safety is never guaranteed, however the manner in which risk is managed and the measures taken to prevent accidents from occurring is a priority.

In 1980 the United States supreme court indicated that the two terms "safe" and "risk free" are not equivalent (Van Dyke, 2009). For example, a safe environment is not necessary an environment free of risk and vice verse. Van Dyke (2009) reiterates Transport Canada's definition of safety by stating that safety is not only managing risk to that of the acceptable levels but also below the acceptable levels. The tolerated acceptable levels of safety were developed from what society (passengers and third parties) perceived and it is made up of the probability of the occurrence and the severity of the consequences. To formally indicate the acceptable levels

of safety, the regulator translated societies' expectations using two metrics safety performance targets and safety performance indicators, that is: desired and realistic outcomes as well as expressions of achieved targets, respectively.

2.2.2 Attitudes

According to Tulloch (1993, p.87), attitude is defined as "a settled opinion or way of thinking". Dutcher (2001) reiterates this but adds that the thought can be about a person, object or issue. He further mentions that attitudes consist of three components, all with regards to the person, object or issue. The three components are a cognitive, affective or feeling, and behavioural.

Due to attitudes being a plausible contributing factor to a number of aviation accidents, such as the 1980s Saudi Flight 163, 1988s Air France A320 crash at an air show and the 1989 British Midlands Flight 163 crash, part of the training and development programs focuses on changing attitudes (Dutcher, 2001).

The change in attitudes should be more positively reflected with regards to flight safety. This in turn would improve the safety practices as well as effective performance. Dutcher's 2001 study was conducted at the Royal Canadian Air Cadet Gliding Program, and assessed the attitudes towards safety within the program. The results indicated no statistical difference of attitudes between instructors and cadets, males and females as well as the amount of flight time experience the individuals had . The results further indicated individuals previous involvement in an aviation incident had a positive effect on their attitudes towards safety training conducted after the incident. Furthermore, from the data it was established that more effective human

factors training programs should be introduced and maintained in order to increase the training personnel's attitudes towards safety.

2.2.3 Safety Climate

The term 'safety climate' was first introduced in 1980 by Zohar (Zhang, Wiegmann, Von Thaden, Sharma, & Mitchell, 2002). Guldenmund (2000) mentions, the attitudes towards safety, within an organisation, are referred to as safety climate. Fogarty and Bukstra (2008) state otherwise by indicating that safety climate is an individuals' perception of organisations practices and processes, which in turn influences the state of safety culture of the organisation. Zohar (2012) supports this by stating safety climate involves employees' perception of selected characteristics of their organisation's environment. These perceptions of the employees are developed based on the rewards and support offered by the organisation. Unlike safety culture, which is developed over a long period of time and is hard to change; safety climate could instantly change which is done through the organisations' leadership priorities. Overall, safety climate can be reflected within the safety culture of an organisation (Jin & Chen, 2013). Further research indicates safety behaviours can be predicted using safety climate measures, utilizing quantitative methods (Håvold, 2007).

2.2.4 Safety Culture

Commonly used by anthropologist, culture is everything learned or acquired by a group of people, society or organisations and is carried over to future members (Wright, Brabazon, Tipping, & Talwaker, 1999). Safety culture is a broad and complex term which does not operate in isolation but is affected by, and affects non-safety related organisational systems or

operational process (Håvold, 2007). Safety culture examines the underlining convictions and belief of the attitudes towards organisational safety, i.e. safety climate (Guldenmund, 2000). Figure 2.1 depicts a traditional concept of culture. Flannery (2001) illustrates the definition of culture, the different types of culture and how they are linked to safety culture.

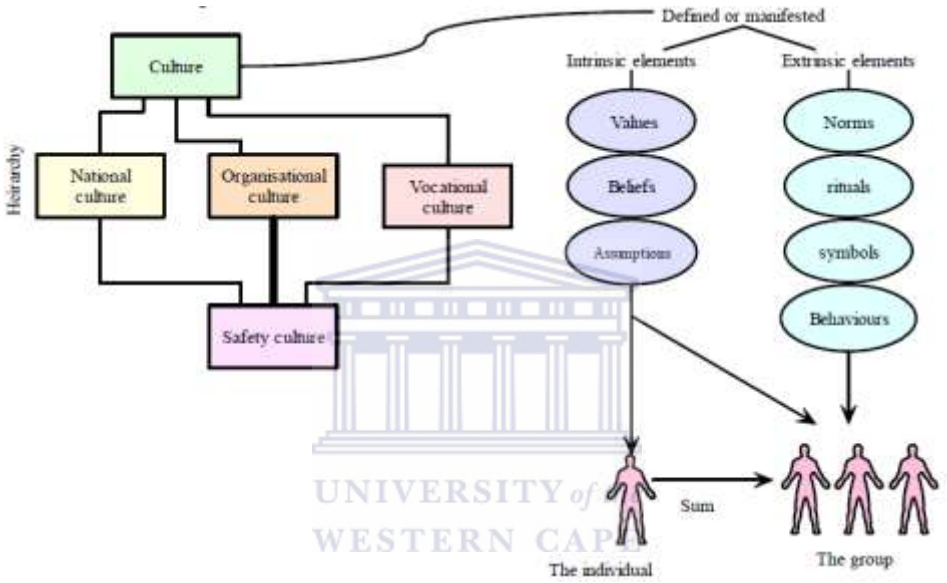

Figure 2.1: Traditional Concept of Culture

Figure 2.1, by Flannery (2001), indicates culture to be manifested into two elements, namely intrinsic and extrinsic. Intrinsic elements are individually related whereas extrinsic elements are group related. Flannery (2001) further depicts the three hierarchies of national culture, organisational culture and vocational culture as separately linked to culture. Culture is directly linked to safety culture but through the three hierarchy cultures. Von Thaden, et al., (2003) conducted research on safety culture and identified five global components which relates to safety culture. These safety components are related to pilots: management involvement, organisational commitment, employee empowerment, reporting systems and reward systems.

However, Gibbons, Von Thaden and Wiegmann (2006) identified a five aspect safety culture model with slightly different factors. Their five aspects were: accountability systems, reporting systems, organisational commitment, pilot empowerment as well as management involvement and all of these aspects contained sub-factors.

According to Van Dyke (2009), safety culture is a set of attitudes and values, with regards to safety, shared among all members of the organisation. Tuner et al., (1989 cited in Cooper, 2002) reiterates Van Dyke's definition of safety culture but elaborates to it and defines safety culture as "the set of beliefs, norms, attitudes, roles and social and technical practices that are concerned with minimizing the exposure of employees, managers, customers and members of the public to conditions considered dangerous or injurious." Cooper (2002) states safety culture to be a sub-component of corporate culture, individual, job and organisational features, which influences safety. In turn, culture alters the attitudes of pilots with regards to stress and personal capabilities (Helmreich, 1999).

Furthermore, safety culture has been defined as the personal commitment and responsibility towards safety of each and every individual, be it on a group or individual level (Von Thaden, Kessel & Ruengvisesh, 2008). Unlike safety climate, safety culture usually utilizes qualitative methods (Håvold, 2007). Between the two terms of safety culture and safety climate, the former is more embracing (Health & Safety Laboratory, 2002 cited by Ek, 2006). Research reveals the two terms are frequently used interchangeably (Cox & Flin, 1998).

There are also a number of factors, personal and cognitive, which contribute to safety culture (Håvold, 2007).Personal factors which are proposed predictors of accidents are education level and age (Ferguson, 1984; Leigh, 1986 cited by Håvold, 2007). Additionally cognitive factors such as perception of risk and attitudes towards safety have been identified as imperative towards motivation and behaviour (Coyle, Sleeman, & Adams, 1995) . Piers, Montijn and Balk (2009) introduce six components, of the safety culture framework in aviation, which supports the assessment and management of a sound safety culture. These components are as follow:

Commitment, which refers to the positive attitude displayed by members of every level within the organisation towards safety. Ultimately, top management should be committed to maintain the highest level towards safety in order to encourage and motivate other members of the organisation to uphold safety practices.

Behaviours refer to the extent to which all levels of the organisation behave towards safety practices. It is imperative for management to recognize and maintain the safety practices as well as provide the necessary aspects in order to do so.

Awareness is the extent to which all employees are aware of safety risk and the impact it has on themselves as well as for those who inquire an operation service form the organisation. Not only management, but also other levels of the organisation should constantly maintain high levels of vigilance towards safety practices.

Adaptability reflects the manner in which management and the rest of the employees conform to a given situation from past experience by enhancing safety practices of the organisation.

Information reflects the extent to which the correct information is communicated to the right people at all times. By encouraging employees to report safety concerns and having clear communication channels hazardous incidents or accidents could be avoided.

Justness refers to the encouragement of safe behaviour and reporting safety issues (or even rewarding it at times) as well as discouragement of unsafe behaviour.

Organisations with positive safety culture attributes are aligned with a number of characteristics. Communication is founded on the basis of mutual trust, there is a common perception of the importance of safety and a confidence exists in the proficiency of preventative measures (The United Kingdom Health and Safety Executive, 2001 cited by Vecchio-Sadus, 2007).

There are a number of cultures which contribute toward safety culture but for pilots there are three main cultures which shape their actions and attitudes, namely: national, professional and organisational culture (Helmreich, 1999). ICAO (2008), figure 2.2, supports this and further states that national, professional and organisational cultures are three distinct cultures yet they operate together. From the three cultures, national culture is found to be the most established culture, hence it would usually be the hardest or the most resistant for individuals to change. However, professional and organisational culture is easier to changed, but the change would be based on the strength of the incentives. Helmreich (1999) further mentions these three cultures to be of utmost importance to the different levels of pilots within in the flight deck (commonly

known as cockpit gradient), as it influences their critical behaviour as well as their how information is shared amongst them. Additionally the cultures contribute to the pilots' implementation of Standard Operating Procedures SOP as they use and value the automation systems (Helmreich, 1999).

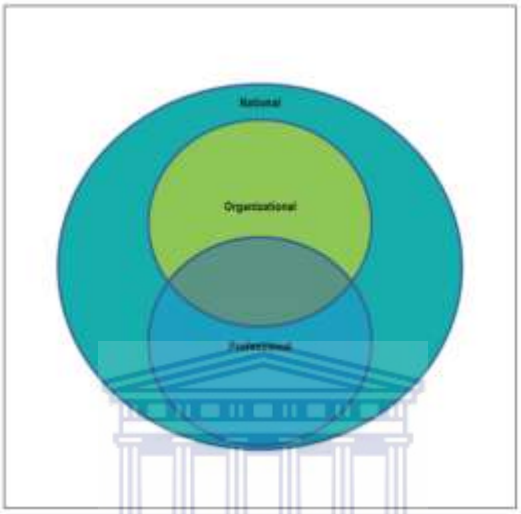

Figure 2.2: Three Distinct Cultures Operating Together

2.2.4.1 National Culture

National culture is shared attributes of national heritage, which includes behavioural norms, attitudes and values (Helmreich, 1999). In 1998 Helmreich and Merrit replicated Hofsted's study to determine the safety relevancy which Hofstede's dimension had on 9000 pilots across eighteen countries. The results indicated national culture should be included to the list of aspects which influence pilots work.

This is with particular reference whereby organisational culture and national culture are conflicting. Hence, this conflict could lead to stress. Soeters and Boer (2000) reported a

momentous relation of cultural variables and accident ratios are linked to national culture. In turn, this is linked to the modern technology as well as the organisational requirements within aviation. But the pilots' cultural background will determine the level of effective operation with regards to a technological advanced aviation organisation.

According to Håvold (2007), the research further indicated that it is best to either have a crew from one national group or a crew which consist of more than two different nationalities. The explanation being, if there is only one group of nationals the decision would be a majority or minority. However if there is a crew which consist of only two nationalities, there might be a conflicting decision, with regards to the values, attitudes and norms which in turn leads to stress. As time moves on, aspects of attitudes constantly changes but the one thing that remains the same and will always be a dominant factor is culture (Håvold, 2007).People's knowledge of actual risk is overshadowed by their choices of what they fear and the fears are what reflect their values. Upon completing his PhD thesis, Lamvik (2002 as cited by Håvold, 2007) concluded national culture to be an important element when considering safety culture.

Language barriers as well as cultural values are major factors contributing towards the difficulty of communication between people from different national cultures (Helmreich, 1999). Although English is a universal language of communication, some cultures are multi-lingual, and these multilingual individuals' interpretation of an English statement could vary. The language barrier in turn could cause the communication problems which could affect the safety practices of the flight crew.

2.2.4.2 Professional Culture

Håvold (2007) states a professional culture reflects the attitudes and values with regards to the occupation. This could include, amongst others, the use of language, tone of voice, appearance as well as the approach to others. A strong professional culture exists within the pilot profession (Helmreich, 1999). These professionals have to endure many years of training to become qualified. In many cases their norms and values are carried with pride and passed onto new recruits. Because pilots are well motivated professionals who enjoy their work, their actions and attitudes contribute towards their organisations safety and efficiency with regards to the operations (Helmreich, 1999).

Von Thaden, Li, Feng, Li and Lei (2006), found that pilots hold a positive perception of themselves and their trainers/instructors. However, their rating indicated they hold a negative perception of their supporting departments, management, and other staff members. This results stems from the pride pilots have in their job as well as themselves within the professional culture. Håvold (2007) further mentions a strong professional culture could have positive and negative aspects. During extreme situations, the dedication and good safety behaviour of professionals could save lives. Inversely, professionals could have unrealistic attitudes with regards to personal capabilities and invulnerabilities which might endanger themselves as well as others (Håvold, 2007). Helmreich (1999) found that pilots regarded their decision making to be good, regardless of the situation which they are in. They also believed their performance is not affected by any external factors, such as personal problems as well as stress.

However, affected personal invulnerability could contribute to the pilots' performance, as in a number of instances they might forget to utilize the Crew Resource Management (CRM) system to eliminate or manage an unexpected error (Helmreich, 1999).

2.2.4.3 Organisational Culture

Håvold (2007) stated organisational culture refers to a basic pattern of assumptions that has been created and reformed by a set group. Those assumptions are then taught to and adapted by the people who form the organisation. Organisational culture serves as a major contributor to behaviour and operates around national and professional culture (Helmreich, 1999; ICAO, 2008).

Safety culture usually prospers at an organisational level and this can be achieved by management introducing policies and encouraging open communications between all units of the organisation. No level of the organisation is immune to culture as the organisational performance influences each level (ICAO, 2008). With regards to a larger organisation, the business unit tends to be the most imperative unit rather than the organisation (Rasmussen, 1997). The study of Gill and Shergill (2004) indicated that organisations, within the aviation industry, consider their employees implementation of safety practices to be more important than that of implementing safety management systems as well as encouraging safety culture. Safety culture is values and norms set by the organisation, be it good or bad, and new entrants to the organisation will socially conform to those standards. Hoole and Vermeulen (2003) found smaller aviation companies expect their pilots to exceed their safety standards, in order to complete the flights and this is due to the companies' budget constraints.

From previous research Edkins and Coakes (2000) found although evidence from anecdotal and accident investigations in the aviation industry suggest employees within the industry often use personal efforts to handle safety issues rather than bringing it to the attention of management. Edkin and Coakes's study indicated otherwise, stating that employees deem safety to be the responsibility of both employees and management.

2.2.4.3.1 Learning Culture

A learning culture within an organisation indicates the organisation has a positive safety culture system (ICAO, 2008). ICAO (2008) does not classify learning culture to form part of the three main cultures contributing to safety culture. However, Håvold (2007) indicated otherwise. He adds learning culture is easy to engineer but is the hardest to work. Learning organisations often improve safety culture as they are willing to adapt and improve with regards to constant changes and developments. Senge (1990), Argyris and Schön (1996) are but a few researchers who offer guides to productive organisational learning. These guides include processes, types of organisational structures and conditions. Håvold (2007) mentions the main barriers of learning culture are information difficulties and blame as well as politics and cover-ups. Additionally, the main problem of learning culture, as a factor of safety, is the lack of definitions as well as the lack of tools to measure the construct.

2.3 Perception of Safety Culture and Risk

In a recent study conducted in an American Collegiate Aviation Program, Adjekum (2014) assessed the perception of both flight students as well as qualified flight instructors towards safety culture within the program. The results varied and revealed, individuals who were longer

in the program had a better perception with regards to the safety culture in comparison to the newer members. This result indicated that experience contributes to the perception of safety culture. Additionally, the results revealed American students had a greater perception of the safety culture compared to expat students. This indicated a national culture difference exist with regards to the perception of the program's safety culture. However, in a study conducted by Gao, Bruce, Newman and Zhang (2013), to determine the effect of pilots rank and their experience level, they uncovered a different result. Less experienced pilots seemed to have a greater positive perception towards safety than their more experienced counterparts.

Thompson (1993 cited in Green, 2001) explored risk perception and proposed three principles: realism, optimism and flexibility affect the personal control of individuals. Individuals naturally use these approaches to adapt to situations. It is imperative to understand flight trainers' perception of risk, whether they classify the nature of activity as high-risk (loss of life or limbs, loss of reputation, and expenditure of large amounts, to name a few) and also identify whether those perceptions are carried over to their trainees (Green, 2001). This is because those perceptions could influence both trainers' and trainees' attitudes towards safety culture.

In most industries there are risk acceptability levels, and although the levels vary from industry to industry (Cooper, 2008), the concept remains the same even within the aviation industry. Risk acceptability serves as a crucial link between safety and risk (Bartsch, n.d). Risk acceptability is set by the regulatory authority, organisation or individual.

2.4 Importance of Safety Culture

The Safety Institute of Australia (2013) states the importance of safety culture not only to have a great influence on the incident and accident rate but also impacts the reliability, validity as well as employees morale. Van Dyke (2009) reported the UK Civil Aviation Authority (CAA) considers safety culture to be an important role which contributes to the success of a Safety Management System (SMS). Additionally, he added that safety culture is linked to the behaviour of individuals. Hence, an organisation's poor safety culture could be displayed in the employees' behaviour and this will be determined from the success or failure of the organisation.

2.5 Safety Culture Measuring Instruments

There are a number of measurements which could be utilized to collect safety culture data. Wiegmann et al. (2004) proposed an instrument which contains organisational indicators of safety culture specifically pertaining to aviation operations. The instrument was developed followed by an initial validation of 84 items on a seven-point likert scale and contained five components of safety culture which are as follows: organisational commitment, management involvement, employee empowerment, reporting systems and accountability systems. However, an instrument of similar nature was developed, validated and revised by Gibbons, Von Thaden and Wiegmann (2005) but parallels the survey from Wiegmann, Von Thaden, Mitchell, Sharma and Zhang's 2003 study which primarily focuses on flight operations. However, the five factors relating to flight operations is a duplicate beside one factor being different, Employee Empowerment (EE) was substituted with Pilot Empowerment (PE) (Gibbons et al., 2005). The aforementioned instruments were based on the initial five factor safety culture model of Wiegmann et al. (2002). In Gibbons, Von Thaden and Wiegmann's (2005) study, with regards to

the development of commercial aviation safety culture survey for maintenance operations, they found three sub-sections within the factors of organisational commitment and employee empowerment. More details of the five factors of safety culture are discussed below.

2.5.1 Organisation Commitment to Safety

There are various definitions to organisational commitment, Gasic and Pagon (2004) identifies organisational commitment as a psychological concept of commitment displayed by an individual towards the organisation they are working for. However, according to Zhang et al. (2002) organisational commitment to safety refers particularly to practices of the organisation's senior management or leadership. Von Thaden and Gibbons (2008) reiterates this and adds the practices of organisations' leadership teams include the allocation of passable resources to safety management as well as decision making. Gibbons, Von Thaden and Wiegmann (2005) identified three sub-sections of organisational commitment to safety as management attitude towards safety, proactive safety (observed practices of management which aims to avoid accidents or incidents) and safety training (which the organisation provides to the employees).

2.5.2 Management Involvement

Within the context of safety culture, management involvement refers to the active participation of upper managers and mid-managers or supervisors in promoting safety within their organisation among their subordinates (Gibbons, Von Thaden & Wiegmann, 2005; Wiegmann et al., 2002). Management involvement towards safety would include contributing towards safety seminars and training, being actively involved in the day-to-day critical safety operations and

displaying good communication towards safety aspects throughout all levels of the organisation (Wiegmann, Zhang, Von Thaden, Sharma & Mitchell, 2002).

2.5.3 Pilot/ Employee Empowerment

Pilot empowerment specifically refers to the flight operation personnel, whereas the initial employee empowerment construct refers to other employees within the aviation industry. Empowerment refers to the individual's perception or attitude towards the instruction, delegation and examples set by senior management (Wiegmann, et al., 2002). Furthermore Wiegmann et al. (2002) states an empowered attitude refers to individuals going beyond what is required of them to do in order to maintain a high standard. In this context the high standards is related to the safety standards. The three subsections of the empowerment which Gibbons, Von Thaden and Wiegmann (2005) identified were authority, professionalism and peer culture. Authority refers to the trust management has in allowing the subordinate to carry out specific duties, professionalism refers to the personal pride subordinates has in their work and peer culture is the support received from peers with regards to safety.

2.5.4 Reporting Systems

Gibbons, Von Thaden and Wiegmann (2005) indicate reporting systems to be the formal organisational system used to report and process safety practices. This would include identifying vulnerabilities and weakness of safety management, but most importantly dealing with it before an incident occurs. Eiff (1999) previously indicated a reporting culture serves as a true foundation to safety culture. The quality and the usability of the reporting systems will support

employees' reports of safety aspects and also provide them with justness feedback (Gibbons, Von Thaden & Wiegmann, 2005).

2.5.5 Accountability Systems

Accountability systems are referred to the systems which are used in order to hold employees accountable for unsafe behaviour (Gibbons, Von Thaden, & Wiegmann, 2006). In another publication Gibbons, Von Thaden and Wiegmann (2006) indicated the system as a reward or an accountability system. They reiterate that the accountability system should be set up in a manner whereby unsafe behaviour is to be punished but adds safe behaviour should be rewarded.

After the initial five factor safety culture model was developed by Wiegmann et al. (2002), a few studies were conducted in similar aviation contexts to determine its validity and also refine the instrument. One of the studies was conducted within the Chinese context in order to validate the commercial aviation safety survey (von Thaden, Li, Feng, Li, & Lei, 2006). The researchers aim was to translate the original commercial aviation safety survey into a Chinese version as well as explore safety cultural aspects for the Chinese context. The results from this study indicated the measure was successfully applied to the Chinese context, however they recommended further measurement equivalence studies should be conducted before applying it widely. In a study by Gibbons, Von Thaden and Wiegmann (2005) they developed a commercial safety culture survey for maintenance operations based on the original safety survey by Wiegmann et al., (2002). Although part of their results was useful pertaining to safety culture at the specific airlines they utilized as their sample, the factor analysis of the five-factor model indicated otherwise. Gibbon, Von Thaden and Wiegmann (2005) indicated the model might not have been as adequate as

expected when the data was described. Furthermore they proposed modifications to the model or a more complex model to be utilised in future studies. In another study conducted by Gibbons, Von Thaden and Wiegmann (2006) in the development and initial validation of a survey assessing the five aspects of safety culture within commercial flight operations they initially came to a similar conclusion. The results indicated a misfit between items in the original safety culture model. However, once Gibbons, Von Thaden and Wiegmann (2006) had revised items on the model, a significant difference prevailed better than the original.

2.6 Human Factors contributing to Human Error

Human factors are not only concentrated on in one particular field, but are in multi-disciplinary fields. These fields include: engineering, psychology, medicine, physiology sociology and anthropometry. The human factors are constantly worked on within these disciplines in order to optimize performance and decrease human errors (Dutcher, 2001).

Modern day aircrafts are highly automated which leaves pilots with minimal cognitive demands within the flight deck (Hardy & Parasuraman, 1997). This in turn has created room for a number of errors, including human error. In fact, 50%- 75% of fatal aviation crash accidents, both military and civilian, was due to human error (Hardy & Parasuraman, 1997). According to Shappell and Wiegmann (2001 cited by Dutcher, 2001) the rate of human error being the cause of aviation accidents has increased 10% to 15%. Although human error is predictable and could be avoided, absolute safety is not guaranteed at any given cost (Van Dyke, 2009). Dutcher (2001) states that human error is inevitable and adds that it would be unreasonable to expect

error-free human performances. Figure 2.3 summarises a few contributing factors of human error which could result in the occurrence of incidents or even accidents (ICAO, 2008).

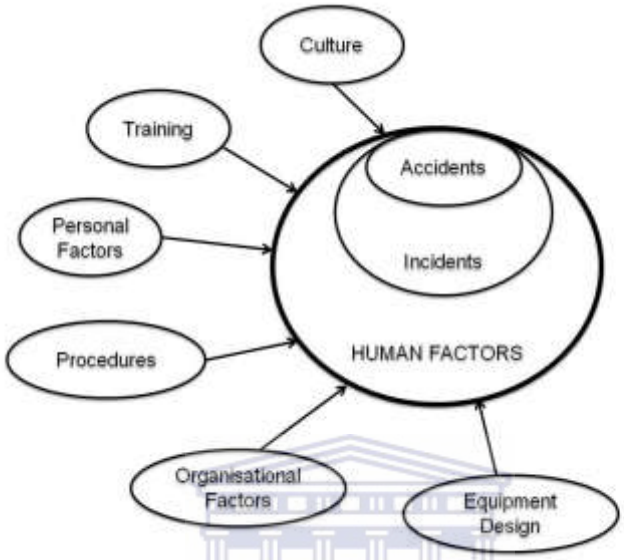

Figure 2.3: Factors Contributing to Human Error

In previous years, pilots required a great amount of physical and perceptual-motor skills in order to control the aircraft. These two attributes are what contributes to human error (Hardy & Parasuraman, 1997). However, due to the modern day automated aircrafts being created, the physical skills are not as vital as perceptual-motor skills. Perceptual-motor skills are imperative when having to make split second decisions, for example when flying through turbulence, and cognitive demands are continuously increasing. Wiegmann and Shappel (2001) mention five human error perspectives being; cognitive, ergonomics and system design, aeromedical, psychosocial and organisational. These errors will be elaborated on in the following sections.

2.6.1 Cognitive

Cognitive models hold the assumption that information is processed through a series of mental operations (Wickens & Flach, 1988 cited by Wiegmann & Shappel, 2001), which lies between the stimulus input and the execution response. The series of mental operations include patterns recognition, attention allocation as well as decision making. When any of the operations does not process the information correctly, errors occur (Wiegmann & Shappel, 2001). Cognitive models are commonly used to identify human error especially within complex situations. This is because it does not only identify the error but also the underlying factors of the error which relates to cognitive failures. Li, Baker, Grabowski, Qiang, McCarthy and Rebok (2003), found the cognitive functions of pilots to deteriorate with age but flight related tasks (take-offs, landings, tracking and even decision-making) does not differ when compared with younger pilots.

2.6.2 Ergonomics and System Design Perspective

The systems perspective indicates that humans are seldom the only cause to error. Human interaction usually consists of other factors, which included themselves, their tools, conditions, and the working environment (Heinrich, Petersen & Ross cited by Wiegmann & Shappel, 2001). Edward's 1988 SHEL model or sometimes known as the SHEL (L) model (ICAO, 2008) puts this into perspective. Figure 2.4 below depicts the model: Software (rules and regulations concerned with the operation), Hardware (equipment), Environmental conditions and Liveware (humans). According to ICAO (2008), if the blocks do not fit together errors would arise.

Figure 2. 4: SHEL(L) Model

The hardware and liveware within the flight deck has been crucial within the aviation industry. Within the first 50 years of aviation, the ergonomics within the flight deck has constantly been redesigned in order to create a suitable match between the pilots and equipment. This in turn contributed to the decrease of accident occurrences (Wiegmann & Shappel, 2001).

2.6.2.1 Training

The purpose of training individuals is to instil good practices into them before they are handed the responsibility to perform those practices on their own (Prikodchenko, 1990). According to Vecchio-Sadus (2007), training people to work safely will not be sufficient. In order for the training to be sufficient, good communication methods should be in place as part of the training. Good communication ensures that people, processes, systems and tasks interact in a co-operative manner to achieve Health, Safety and Environment (HSE) objectives. The manner in which safety is communicated will influence peoples' understanding and participation in the safety process. Additionally, the language used will determine whether the communication was acceptable or not. Edkins and Coakes (2000) mentioned one of the best strategies for enhancing

safety culture is ensuring that employees receive sufficient training and information with regards to safety.

Employees' awareness, with regards to the organisation's safety, contributes to their motivation and actions when facing a safety situation. Flying instructors are the main source for training new pilots, however they hold additional responsibilities. These instructors also have to ensure they instil safety values into their students (Freidwald, Lenz-Anderson, & Baker, 2013).In previous years a vast majority of instructors were mostly experience professional individuals who were able to pass on their experience to their students. Freidwald, Lenz-Anderson and Baker (2013) recently discovered that a number of North American instructors are young and inexperienced. These instructors only have a year, or even less, experience as to their cadets. The instructors use the instructors rating as a stepping stone to enter the commercial flight deck in a relatively short period of time. This leaves the newer pilots being even less experience. However, there are also economic forces which contribute to younger pilots being instructors. There is currently an inverse relationship between economic conditions and instructors' experience.

June the 1st 2009 an Air France commercial airline, Flight 447 en route from Rio de Janeiro to Paris, plummeted into the Atlantic Ocean from 35, 000 ft in the Air. This aviation accident made world headline as 228 lives were lost (Whitefield, 2012). The Bureau of Enquiry and Analysis for Civil Aviation Safety's report (2009) of the accident indicated it to be a human error as the flight deck crew failed to recognize the situational error. The failure of recognising an aircraft stall and remedying the situation with the appropriate measures led the crew to becoming de-structured in the situation. The investigation of Flight 447 left the Bureau in question about the training pilots receive.

2.6.2.2 Experience/ Rank

It is known that the world is facing a shortage of skilled professionals as well as technicians. And this is not unfamiliar to the aviation industry, especially in South Africa. In his interview with the CEO of SA CAA, O'Sullivan (2008) learned the shortage of skilled individuals is having an impact on the aviation industry, not only with pilots but also maintenance and technical staff. Although the Federal Aviation Regulation 14 states no pilot over the age of 60 years should be flying cargo with a maximum of 10 passengers; the SACAA implemented its own rules. The 1960 "age-60" rule has been under scrutiny since its implementation (Li et al., 2003). In order to remedy the situation for a short period of time, the SACAA changed the retirement age of pilots from 60 to 65 years of age as the gap of skilled experienced pilots is not being filled faster than expected. The flight experience of older pilots was found to counter act their age related performance deficiencies, i.e. certain communication of task (Li et al., 2003). However, in a safety climate study conducted by Gao, Bruce, Newman and Zhany (2013) their results differed. They found pilots with higher rank and more experienced to be less positive towards safety climate as opposed to their younger counter parts.

2.6.3 Aeromedical

The aeromedical approach refers to the physiological conditions of the aviators (Wiegmann & Shappel, 2001). These conditions include dehydration, hypoxia, fatigue or even spatial disorientation which could all be due to a number of aspects. The physiology of pilots contributes to their performance and theorists believe a malfunction of pilots' physiology affects the interaction of the SHEL model which leads to errors. Fatigue is the aeromedical condition

which gained much attention and serves as a contributing factor to human error (Petrilli, Roach, Dawson, & Lamond, 2006).

2.6.3.1 Fatigue

A number of individuals, within different industries, suffer from fatigue which is related to sleep loss as well as circadian rhythm disruptions. Commercial pilots may also experience fatigue due to a number of factors (irregular sleep, long distance flying, night flying and change in time zone flying) (Petrilli et al., 2006). In his empirical study to determine the relationship between pilot schedules and aviation accidents, Goode (2003) indicated flying schedules to also be a factor impacting on fatigue. The results indicated when the flying time of United States aviators increases (i.e. their flight schedule increases) there is an evident pattern of increased probability of an accident occurring (Goode, 2003).

In a study done on military pilots performing shift work, it was found that shift work could lead to circadian descynchrony which affects the performance and functioning of these aviators (Rabinowitz, Breitbach, & Warner, 2009). Fatigue of aviators affects their safety actions as it "causes decreased short-term memory, slowed reaction time, increased error of omission, increased variability in work performance and worsened mood" (Mohler, 1966 cited in Taneja, 2007, p.281).

Taneja (2007) further discovered a number of aviator respondents indicated early morning or late night flying affects their sleeping pattern which causes fatigue. The aviators further admitted, due to sleep deprivation, they would feel drowsy in the flight deck and sometimes fall into

micro-sleep. This phenomenon was more common in transport flying and uncommon to fighter pilots. Micro-sleep is an involuntary sleep which ranges from a few second but does not last longer than a few minutes. Although newer aircrafts are mostly automated (Hardy & Parasuraman, 1997), micro-sleep could cause detrimental effects in the flight deck and lead to safety hazards.

Fatigue has been reported to be the cause of a number of aviation accidents as well as incidents (Petrilli et al., 2006). According to NTSB (2002, cited by Petrilli et al., 2006) fatigue was the major cause of a Boeing 727 collision which crashed short of the runway on final approach and collided in the trees. Additionally, in 2001 the Swiss Aircraft Accident investigation found flight CRX 3597's accident was due to the captain's fatigue. This lead to his inability to concentrate, make appropriate decisions as well as analyze the complex process.

2.6.4 Psychosocial

The psychosocial perspective indicates flight operations to be of a social interaction and the performance of pilots are linked to the quality of the interaction of the team members (Helmreich & Foushee cited by Wiegmann & Shappel, 2001). The flight operation team members are made up of the pilots, dispatchers, flight attendants, air traffic controllers, ground crew and maintenance personnel (Wiegmann & Shappel, 2001). The psychosocial factors also include other external factors, within the human social environment which impacts individuals' work and non-work environment (ICAO, 2008). Communication and teamwork also relates to psychosocial, and it was found that 70% of accidents were due to poor communication of aircrew members.

2.7.5 Organisational

By 2001 the organisational approach to human error was as common in the aviation industry as compared to other industrial industries. Previously emphasis was placed more on the aircraft and aircrew rather than the organisation, but the organisational approach serves as a contributing factor to human error (Wiegmann & Shappel, 2001). Wiegamann & Shappel (2001) further indicate with the constant evolvement of new discoveries, safety practitioners are realizing the complexity of aviation incidents and accidents as well at the importance of organisations managing human error.

2. 7 Human Factor Analysis and Classification System

2.7.1 Managing Safety

2.7.1.1 Safety Management Systems

In 2006 the Australian Civil Aviation Safety Authority described Safety Management Systems (SMSs) as a system which integrates work practices, procedures and beliefs to ensure that operations are conducted in the best possible safe manner. The system identifies possible errors and indicates measures to counteract it in order to reduce the occurrence of incidents or accidents. According to Van Dyke (2009), safety culture is also a contributor to the successful implementation of SMSs. This implementation is evident from the UK Civil Aviation Authority (CAA) as they consider the success of SMSs to be dependable on active practices of safety culture. Without the actively and continuous practice of safety culture SMSs would not be effective. However, SMSs are not effective if the organisation does not have adequate safety culture. Gill and Shergill (2004) stated SMSs are designed knowing that there will constantly be threats to safety. By ensuring constant safety and the effectiveness of the SMS, threats are

identified and managed before accidents occur. SMSs allows the involved parties to identify and control hazards and at the same time minimize risks in order to manage aviation safety effectively (Freidwald, Lenz-Anderson, & Baker, 2013).

Edkins and Coakes (2000) discussed the INDICATE safety management program and describes it as a SMS. The system is used for standard public transport systems as well as aviation charters to improve the safety practices. The INDICATE SMS is a structured process which ensures that regular communication takes place, between airline staff, to ensure a high quality of safety feedback exists. This practice would be achieved by covering six core steps:

"1. Conducting a series of staff focus groups to proactively identify safety hazards within the airline;

2. Establishing a confidential safety reporting system;

3. Conducting monthly safety meetings with management;

4. Maintaining a safety information database;

5. Electing an operational safety officer who is available to staff as a confidante for safety related issues;

6. Ensuring that safety information is regularly distributed to all staff." (Edkins & Coakes, 2000, p.7)

SMSs along with safety culture are a constant interest with regards to ensuring safety and have also been an interest of regulatory authorities, such as the UK CAA (Gill & Shergill, 2004). The Aviation Authorities value SMSs as it ensures high levels of safety performance, but indicates

that risk management is associated with flight operations. It is not only the duty of flight operators to manage risk, related ground operations, maintenance activities and aircraft engineering is also responsible for managing the risks. An SMS approach requires the involvement of the entire flight operations team (i.e. pilot crew, maintenance and support personnel) to cooperatively work together and increase aviation safety (Freidwald, Lenz-Anderson, & Baker, 2013).

During the period of April 2010 and July 2011 Freidwald, Lenz-Anderson and Baker (2013) conducted a study at an American multinational flight training organisation due to the organisation's high incident and accident rate. In the fifteen month study period 25696 hours were flown, along with an array of incidents and accidents. These included two fatal accidents, four engine fires, five haul loses and 27 pilots induced incidents of which required unscheduled maintenances. All these incidents involved either student pilots doing their solo flight or occurred on an aircraft being retailed. However, during this fifteen month period no incidents or accidents occurred at the organisations UK branch. Although the serious events were not linked to each other, Freidwald, Lenz-Anderson and Baker (2013) found the American multinational flight training organisation did not have a SMS program in place or even any proactive system, beyond a quality assurance program.

2.7.1.2 Crew Resource Management

Minimal interaction and collaborative teamwork within the flight deck lead to 70% of aviation incidents (Dunn, Milla, Neily, Crittenden, Carmack, & Bagian, 2007). In 1979 Crew Resource Management (CRM) was introduced and implemented in training programs, with its focus being

specifically on human errors which contributes to aviation accidents. Dutcher (2001) adds that it is a globally accepted valuable tool within the aviation industry. With the advanced aircraft automation system and the constant technological evolvements, working with these automation systems could be difficult. Hence, CRM was introduced in the aviation industry, to manage working with these factors, with specific focus on crew co-ordination, leadership, effective communication and human factors involved. CRM in the aviation industry is the effective usage of all resources within the industry to achieve the highest possible level of safety. These resources include the aircraft systems, documentation and aircraft computer software, and the humans involved (Dutcher, 2001). The CRM was developed from the SMS, as it not only involves the flight personnel in the flight deck but also the entire flight crew, air traffic controllers and aviation maintenance personnel (Dunn, et al., 2007).

Although the CRM system has been introduced worldwide in order to manage and possibly avoid human errors which are the cause of aviation accidents, Engle (2000) is concerned about the effectiveness of the system within the different cultures of the world. He mentioned the initial development of the system was tailored to the Western Culture and could be biased towards other cultures. Hence, Engle (2000) recommended the CRM system should be adapted to other cultures in order to increase its effectiveness.

The health care industry has often being compared to the aviation industry in a sense that the two are highly professional industries which deal with high-risk situations (Kao & Thomas, 2008). Additionally, in both industries an error can lead to a detrimental effect on the company. Individuals could lose their lives and this could have an impact on the company's finances as

well as its reputation. It has been reported that a number of healthcare incidents were due to human error. Given the succession in safety practices within the aviation industry, after the implementation of the CRM system, the medical industry is adapting the system and implementing it to increase their safety practices (Kao & Thomas, 2008). This would serves as a means to improve patient care as well as patient safety and possibly manage risk or even avoid it before it occurs.

To date, CRM systems have been applied in operating rooms, labour delivery units and even emergency rooms (Dunn, et al., 2007). The standard safety practices, checklist, team briefing and communication protocol, initially implemented for the flight deck are now being used to constantly improve patient care (Konschak & Sirois, n.d.). A study conducted on CRM among both flight and cabin crew members at Saudi Airlines revealed crew members knew and understood the importance of CRM, especially being in a multi-cultural organisation (Metscher, Smith, & Alghamdi, 2009). Saudi Airlines is known as a multi-cultural organisation as they employ crew members from up to 50 different countries. Metscher, Smith and Alghamdi (2009) further noted that good communication has a great impact on the effectiveness of teamwork as well as safety practices. Although the study was only conducted at Saudi Airlines, the authors indicated the results to be generalizable across other multi-cultural airlines.

2.8 Conclusion

Literature with regards to safety culture within the aviation industry, especially among pilots, was reviewed. Firstly Safety was discussed along with the different cultures which contribute towards safety. The perception of safety and risk was also discussed along with the importance

of safety and factors contributing to human error. The final section of this literature review discussed the management of safety systems.

CHAPTER 3: Research Design

3.1. Introduction

This chapter aims to discuss aspects related to the research design of this study. These aspects includes the following: research objectives, research methodology, population which was investigated, the sample used, the sample characteristics, method of data collection, description of the instrument used, the statistical analysis as well as ethical considerations faced.

3.2. Research Objectives

The research objective of this study is to assess safety culture of professional pilots within selected South African based aviation organisations and determine whether any factors affect the pilots' safety culture. Additionally, recommendations will be proposed in order to guide future research which will be conducted within the South African aviation industry.

3.3 Research Methodology

Sekaran (2002) stated the research design contain a series of rational decision-making choices. These choices includes factors with regards to the purpose of the study (descriptive, exploratory, hypothesis testing), location of the study (the study setting), the type of study (investigation type), the extent of the researchers manipulation and control over the study, time horizon as well as the analysis level of the study.

According to Bui (2009) there are two types of research, quantitative and qualitative. Quantitative research collects numerical data to answer research questions. The data generated could also be in the form of percentages and data is collected using one or more measurement instruments. The hypothesis of the study would then be confirmed or unconfirmed using the generated results. The advantage of the quantitative research is; the researcher has control over a number of the research aspects and with a large enough sample size the results can be generalizable. Additionally, this method of research saves time and money. The disadvantages of quantitative research could include the researcher having minimal direct contact with the participants and also the responses could be limited to the options provided.

Qualitative research is quite different to quantitative research (Bui, 2009). This type of study collects non-numerical data, which is narrative, hypotheses are seldomly used and usually does not require a large sample size. Some of the advantages of this research includes that the researcher would have researched the topic in depth, the data would be interpreted based on the participants perspectives and a holistic picture would be created of the situation. The disadvantages of qualitative research are that it requires a large amount of time and it could be costly to perform.

This study employed a quantitative research design at various South African based aviation organisations as numerical data was used to answer the questions which relates to the safety culture of pilots. Furthermore, the questionnaire was a cost effective and convenient way of obtaining data due to the fact that the pilots are constantly flying.

The type of study was exploratory and the time horizon was cross-sectional as one set of data was collected over an eight month period. An exploratory study was conducted as little is known about safety culture of pilots, specifically within the South African context. However, as the research progressed answers around safety culture as stated within the research objectives were found.

3.4. Population

Bhattacherjee (2012) defined a population as an entire group of people, things of interest and events that a research wants to investigate. The population investigated was professional pilots within approximately fifteen South African based aviation organisations. This means that the pilots fly as a career for a commercial airline, a charter company or even the military. These pilots were either a Captain, Senior First-Officer (S/FO) or First-Officer (FO) and fly either domestic or regional routes within the Southern African Developmental Community (SADC). The pilots contributed to the study as their safety culture was the primary investigation of the study.

3.5. Sample Characteristics

3.5.1. Sample Size

A sample is defined as a subsection of a population (Kothari, 1990). The sample would usually be a representative amount of the population. However, the sample does not always contain all the elements of the population. Conclusions can be drawn from a survey administered to the sample of the population. If the sample is a representative amount of the population the results can also be generalizable for the population.

The pilot population was estimated to be around 1300 pilots within selected based South African aviation organisations. Sekaran (2002) recommended the sample size to be 297 pilots of the actual population. This would be a representable size of the population and could then be generalizable within the airline industry. However the total amount of useable responses received were 104.

3.5.2. Sampling Procedure

A non-probability sampling design was utilized in this study. By utilizing this type of design, the population had a non-probability chance of been selected as a participant in the study (Bhattacherjee, 2012). The type of non-probability design suited for this study was a convenience type. This indicates information was collected from members of the population who were conveniently available to provide information. Although the questionnaire was sent to the pilots, they had a choice to complete the questionnaire or not.

3.5.3. Considerations Regarding Sampling

According to Bui (2009), the administration of a non-probability sampling design is time and cost effective. Additionally, this type of design was more dependable than others and uncovered useful information with regards to the population. The disadvantage associated with non-probability sampling do not allow for the results to be confidently generalizable to the population. Furthermore, the population which was investigated was one level of employees at several aviation organisations of the same nature.

3.6. Method of Data Collection

Data can be collected in different settings from different sources, i.e. primary or secondary. For the purpose of this research primary data was collected by means of a self-administered questionnaire directly from participants. A questionnaire is a pre-formulated set of questions addressing the research objectives, most of the time, with restricted alternatives (Bhattacherjee, 2012).

3.6.1. Procedure for Data Collection

Data was collected from various South African based aviation organisations, with permission granted from the organisations' management. Two methods of distribution were utilized in order to collect data from pilots. The self-administered questionnaire was distributed to the pilots via their organisation, which was either in the form of a paper based or a web based. Pilots who received the paper based version were required to return their completed questionnaire to the researcher. The web based version of the questionnaire was created on www.**google**.com/**forms** and a link to it was generated. The link of the questionnaire was then e-mailed to pilots, via their organisation, which allowed the pilots to instantly submit their response directly to the researcher. The paper based version as well as the web based version for the questionnaire contained a cover letter as well as a short description of the research which was conducted. The letter attached ensured the information candidates provide will be treated with confidentiality and anonymity. Furthermore, pilots were requested to encourage their colleagues to participate in this research.

3.7. Research Instruments

For the purpose of this research, a self-administered questionnaire was adapted from Gibbons, Von Thaden and Wiegmann's 2005 survey which assessed safety culture of maintenance and flight operations in airlines. Their validated and adapted study was based on the safety culture questionnaire by Wiegmann, et al., (2002) which contained 84 items and rated on a 7-point likert scale. The five factors on the questionnaire related to maintenance operations were identified as; Organisational Commitment (OC), Management Involvement (MI) Employee Empowerment (EE), Accountability System (AS) and Reporting System (RS), (Gibbons, Von Thaden & Wiegmann, 2005). However the five factors relating to flight operations is a duplicate beside one factor being different, Employee Empowerment (EE) was substituted with Pilot Empowerment (PE) Gibbons et al., (2005).

The adapted questionnaire for this research consists of two sections; Section A: Biographical information and Section B: questions relating to the safety culture of flight operations personnel. The flight operations personnel consist of Captains (Capt), Senior First- Officers (S F/O) and First-Officers (F/O). The questions of section B covered the five original flight operation factors proposed by Wiegmann, Zhang, Von Thaden , Sharma and Mitchell (cited in Gibbons et, al.2005) and contains a total of forty-nine items (see appendix). These forty nine items were selected with assistance from flight operations subject matter experts who indicated which items, from the survey for maintenance operations, would be applicable to them. The items was rated using a 5-point likert scale as opposed to the original 7-point likert scale used by Wiegmann. This was done in order to create a slight ease for the respondents when choosing a desired scale for each of the forty-nine items.

3.7.1. Biographical Questionnaire

The biographical section of the questionnaire consisted of 12 items. These questions included the job title of the pilot, gender, home language, flying training, fleet qualification as well as the base they are stationed at to name a few.

3.7.2. Safety Culture

As previously mentioned the questionnaire for this study contained 49 items and were rated on a 5-point likert scale. The scale is as follows:

1-strongly disagree

2-disagree

3-neutral

4-agree

5-strongly agree.

The 49 items were spread across factors relating to flight operations and are:

Organisation Commitment (OC)

Management involvement (MI)

Pilot Empowerment (PE)

Accountability System (AS)

Reporting System (RS).

In order to eliminate biasness from the respondents, the above mentioned factors relating to flight operations was not presented in the questionnaire of the respondents. Additionally, the questions have been shuffled in no particular order and listed from 1 to 49. The respondents were only required to provide one answer per question.

3.8. Reliability and Validity Measures

The psychometric properties of the questionnaire included reliability and validity. "Reliability of a measure refers to the consistency with which it measures whatever it measures" (Foxcroft & Roodt, 2009, p.47). Foxcroft and Roodt (2009) further mention various types of reliability exist, i.e. test-retest, alternate-form, split half, inter-item consistency, inter-scorer reliability and intra-scorer reliability. The acceptable magnitude coefficient of reliability varies to the content been measured but is acceptable from 0.65.

Additionally, the validity of a measure looks at what the test measure and how well it does that (Foxcroft & Roodt, 2009). The magnitude of the validity coefficient should be high enough to reach a statistically significant level at 0.05 and 0.01. The study focused on both the reliability and validity of the questionnaire.

According to Von Thaden and Gibbons (2008), in an initial test by Wiegmann et al., (2003) of the flight operation's survey development and revision indicated the reliability to be greater than α=.70. However the item-level analysis indicated a number of poor items. Furthermore, a subsequent study took place with a larger sample and indicated less favourable results. After further changes were made to the Safety Culture Indicator Scale Measurement System

(SCISMS), studies and validation efforts indicated a gratifying reliability coefficient per indicator (α =0.81-0.95). Additionally, the development of a commercial aviation safety culture survey for maintenance operations by Gibbons, Von Thaden and Wiegmann (2005) was conducted based on the original five-factors of safety culture. The new revised model contained the five safety culture factors with organisational commitment to safety and employee empowerment been divided into three sub-sections.

The reliability of the questionnaire utilized in this study was calculated based on the Cronbach Alpha (α) coefficient. The α coefficient of the total questionnaire was found to be 0.961, however the α coefficients varied across the five subsections of the questionnaire and is displayed in the table below.

Table 3.1: Safety culture factors and α coefficients

Safety Culture Factor	α Coefficients
Organisational Commitment to Safety	0.913
Management involvement	0.623
Accountability systems	0.767
Pilot empowerment	0.901
Reporting systems	0.795

From the table above (table 3.1) the α coefficients of the questionnaire factors were between 0.623 and 0.913. These reliability factors were within acceptable regions.

3.9. Rationale

The rationale for the use of this questionnaire is for a number of reasons. Firstly the questionnaire measured what the study was aimed at, assessing safety culture of pilots. Secondly, the 5-ponit likert scale made it easy for the respondents to select and an answer. Thirdly, the reliability level of the initial questionnaire was within acceptable ranges. Hence, this questionnaire was a suitable data collection method for this study.

3.10. Statistical Analyses

The statistical analysis of the research data was done by utilizing the statistical computer programme Statistica Version 8.1. The raw data was inserted into the program and various statistics were generated from the raw data.

3.10.1. Descriptive Statistics

According to Rugg and Petre (2007) descriptive statistics is obtained by transferring raw data into information which is used to describe a set of factors of a situation. The descriptive statistics can be in the form of frequencies, dispersion and measures of central tendencies. This study utilized frequencies as a means of descriptive statistics.

3.10.1.1. Frequencies

Frequencies refer to the amount of times a category appears and this is presented in the form of percentages as well as cumulative percentages (Sekaran, 2002).

3.10.2. Inferential Statistics

Rugg and Petre (2007) indicated that inferential statistics are used to make inferences about data. This includes drawing conclusions from the relations between two variables, identifying the differences in variables among sub groups and inferring how independent variables could explain the variance in a dependant variable.

3.10.2.1 Pearson Correlation

Pallant (2010) stated a correlation analysis describes not only the direction but also the strength of the linear relationship among two variables. According to Sekaran (2002), the direction can either be positively or negatively correlated. For example; the correlation range would be between -1.0 and 1.0 (a strong negative correlation and strong positive correlation, respectively). However, a correlation with a factor of zero indicates, there is no relationship between the variables.

A Pearson correlation is utilized for interval level variable as well as continuous level variables (Pallant, 2010). For the purpose of this research, the relationship between two variables of the safety culture model was investigated. These results uncovered the nature, direction and significance of these variables, which is besides uncovering the standard deviation and mean of these variables (Sekaran, 2002).

3.10.2.2 Analysis of Variance (ANOVA)

Unlike Pearson correlation, Anova examines the significant difference between more than two groups with a dependable variable on either an interval or ratio scale. Sekaran (2002) further mentioned the Anova results are interpreted by means of the F statistic which indicates whether or not the two sample variances differ from each other. The safety culture factors used in Anova were organisational commitment to safety and pilot empowerment along with the biographical factor of pilot rank which consisted of three groups (Captain, Senior First-Officer as well as First-Officer).

3.10.2.3 Multiple Regression

According to Kothari (1990) multiple regression provides the variance of the dependant variable when simultaneous exertion is placed on a number of independent variables. Furthermore, Sekaran (2002) adds that multiple regression is not only utilized in the aforementioned explanation, as a determinant variance correlation, but may also be utilized to determine the inter-correlation or association between factors. The inter-correlation among the independent variables would indicate whether or not it is jointly regressed against the dependant variable. During this research multiple regression was used to determine whether there is an association between factors of the safety culture model.

3.11 Ethical Issues

According to Fouka and Mantzorou (2011) upon doing research there are ethical considerations to be noted by the researcher when collecting data. Research ethics involves protecting the

dignity of the subjects which provide information for publication. Fouka and Mantzorou (2011) further stated there are a number of aspects to consider when doing research. These aspects include: Informed consent, respect for anonymity and confidentiality and respect for privacy. Hay (2015) reiterated this but included the factors of deception as well as withdrawal from investigation. These ethical factors were taken into consideration during the research to assess safety culture of professional pilots within South African based aviation organisations.

Participation of this research was voluntarily as no participants were forced to respond. Before proceeding to complete the questionnaire respondents were required to provide consent and this was in the form of agreeing to the terms of the research. The terms of research explained the use of the data participants are to provide and also ensured them the data will only be available to the research team.

Furthermore, the respondents were ensured that their confidentiality, anonymity and privacy will be protected. This was also part of the terms which they agreed to before completing the questionnaire. Additionally, participants were informed that a summary of the completed report will be sent to their organisation. This will be done in order for them to understand their practice and possibly improve on current functioning. Furthermore, before the questionnaires were distributed to the pilots, permission was obtained from the organisations in order to conduct research among their pilots.

3.12 Conclusion

In summary, this chapter has provided an explanation of the research designed employed in within this study.

During the following chapter the results will be presented based on the analysis and a discussion will be conducted based on the results.

CHAPTER 4: Presentation of Results

4.1 Introduction

The previous chapter contains the research methodology of this study which serves as a basis for the following chapter as it provides the results which were found in this research study. The results which will be presented in this chapter were obtained from the instrument, questionnaire, used to collect data based on the construct of Safety Culture.

The statistical analysis in this chapter consists of descriptive statistics as well as inferential statistics which will then follow. The descriptive statistics is based on the information obtained from the biographical section of the questionnaire and will be presented in the form of bar graphs and tables. Furthermore descriptive statistics are usually in the form of frequencies or percentages. The data presented will be based on the characteristics of this sample size (n=104). The inferential statistics covers the aspects of safety culture which consist of Organisational Commitment to Safety, Reporting Systems, Accountability Systems, Pilot Empowerment as well as Management Involvement. The statistical analysis was conducted using the statistical computer programme Statistica Version 8.1.

4.2 Results

4.2.1 Biographical Information

The analysis of the biographical data will be presented below in the form of graphs. A description of each graph will also be given as a form of explaining the graph. The following

biographical information will be presented below: gender, ethnicity, age, job tile as well as years of flying experience.

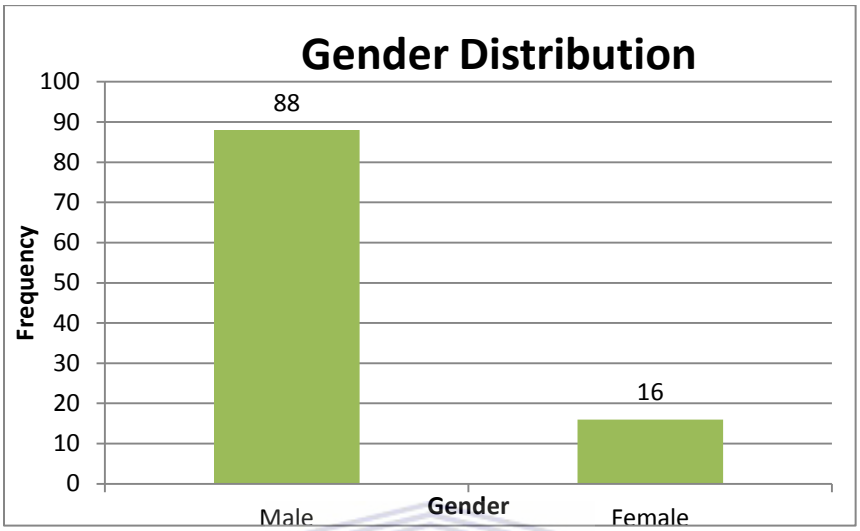

Figure 4.1: Gender distribution

Figure 4.1 depicts the gender distribution of the respondents which indicates a majority of the respondents were male (84.6 %, n= 88) and the remaining respondents were female (15.4% n= 14).

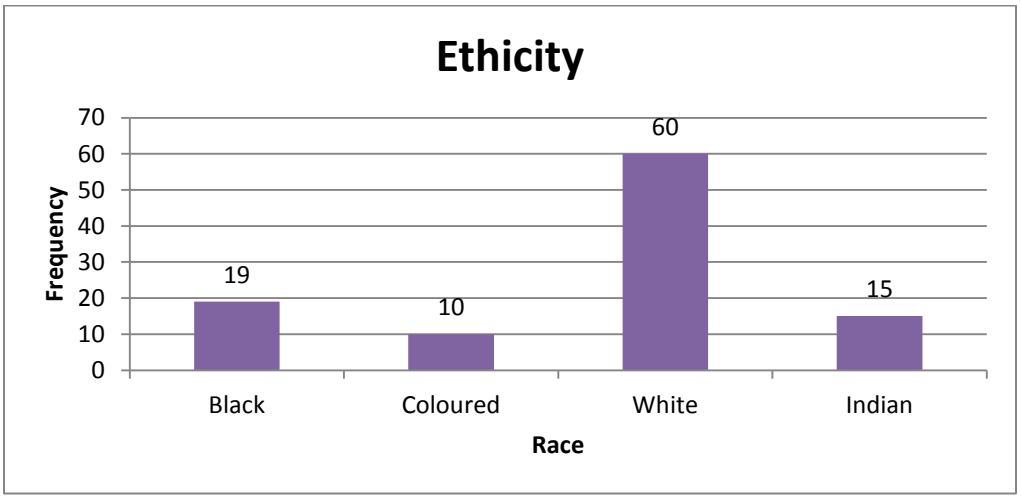

Figure 4.2: Ethnicity

Figure 4.2 illustrates the largest portion (57.7%) of the sample were white (n=60) and the smallest portion of respondents were coloured (9.6%, n= 10). The second largest portion of respondents were black followed by indian people, (18.3%, n=19 and 14.4%, n=15) respectively.

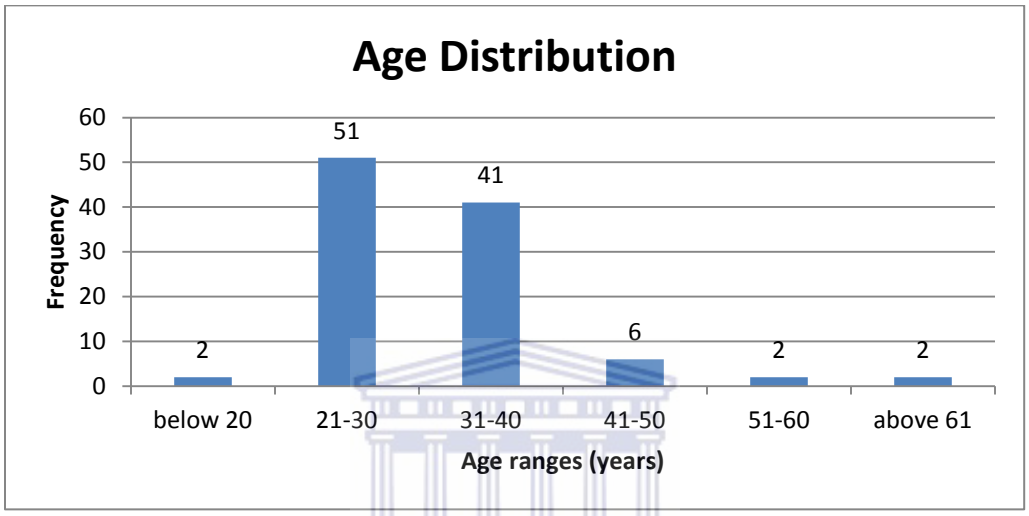

Figure 4.3: Age Distribution

The age distribution of the respondents is displayed in figure 4.3 within age ranges. It was found the greatest amount of respondents were within the age range of 21-30 years (49.0 %, n=51), followed by 31-40 years of age (39.4%, n= 41). Furthermore 5.8% of respondents were within the age range of 41-50 years (n=6). The least amount of respondents were below 20 years of age, between 51-60 years and above 60 years of age (1.9 %, n= 2) respectively.

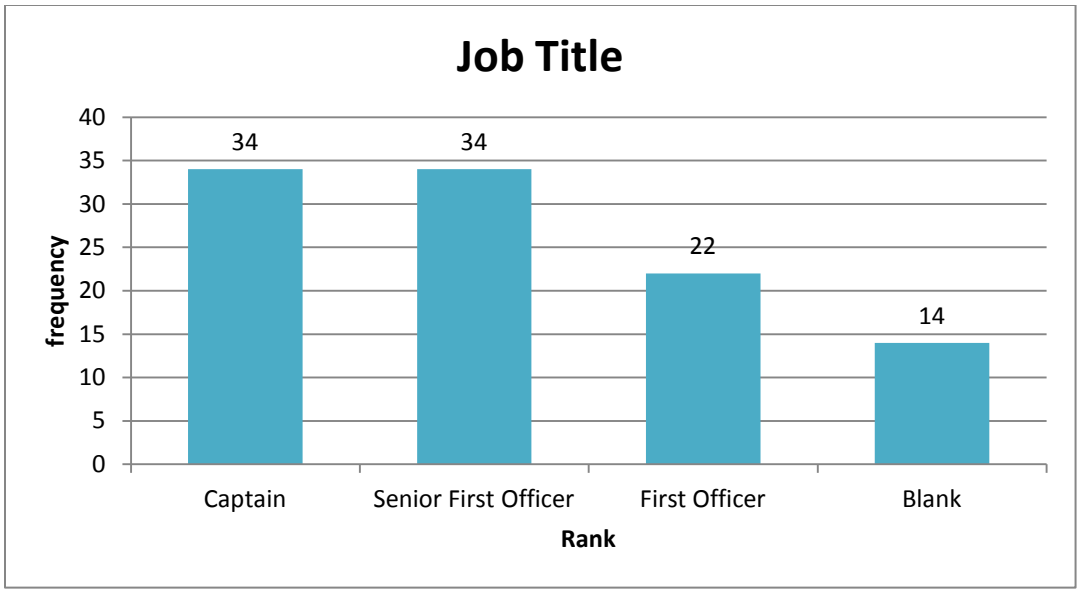

Figure 4.4: Job Title

Figure 4.4 is a graphical representation of the sample's job tile. There were an equal amount of Captains and First Officers who participated in this research (32.7 %, n= 34) respective. This amount was followed by the Senior First-Officer respondents (21.2%, n=22). Furthermore, there were respondents that did not indicate their job title and left the question blank (13.5%, n=14).

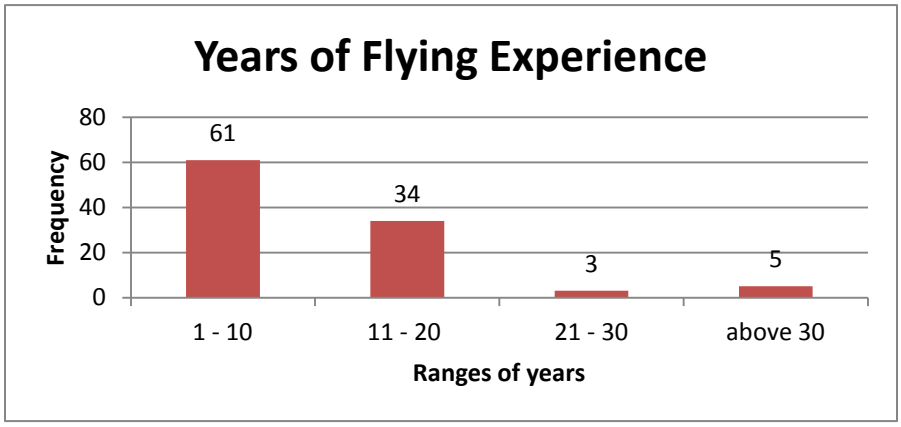

Figure 4.5: Years of Flying Experience

From the frequency distribution in figure 4.5, it is apparent that 58.7% of the sample (n=61) have between 1 to 10 years of flying experience and 32.7% (n=34) had flying experience between 11 to 20 years. The respondents which had between above 30 years of flying experience constituted 4.8% of the sample (n=5) and 2.9% of the sample indicated to have between 21 to 30 years of flying experience (n=3). There was a 1.0% of the sample (n=1) who did not indicate the amount of flying experience.

Table 4.1: Descriptive Statistics of Total Years of Flying Experience

Descriptive Statistics							
Variable	**Valid N**	**Mean**	**Minimum**	**Maximum**	**Lower Quartile**	**Upper Quartile**	**Standard Deviation**
Total years of flying experience	103	10.69	1	42	5	13	8.09

In table 4.1 the lower (25Q) and upper (75Q) quartiles for years of training are presented, which were respectively 5 and 13 years, which showed that some of the pilots have not been employed for an excessive number of years.

4.2.2 Results of the Pearson Correlation analyses

The following section provides the results of hypotheses which were tested using the Pearson correlation analysis.

Hypothesis 1: There is a statistically significant relationship between the years of experience pilots have and pilot empowerment.

Table 4.2 Pearson Correlation between the years of flying experience pilots have, their total flying hours and pilot empowerment

Pilot Empowerment								
	Subtotal: Pilot Authority		Subtotal: Professionalism		Subtotal: Peer culture		**Total Pilot Empowerment**	
	r	P	r	P	r	P	r	P
Years of experience	0.038	0.706	0.119	0.232	0.126	0.206	0.118	0.237
Total flying hours	0.002	0.984	-0.038	0.701	0.052	0.605	-0.003	0.973

r: Regression, P: Significance

Table 4.2 indicates the relationship between the years of flying experience and total pilot empowerment. The results indicate there is no statistically significant relationship between the years of flying experience and total pilot empowerment (r= 0.118, p> 0.05).

Subsequently, table 4.1 also depicts no statistically significant relation exist between the years of flying experience the sample has and any of the pilot empowerment subsections. These subsections are pilot authority, professionalism and peer culture (r=-0.038, p>0.05; r=0.119, p>0.05; r=0.126, p>0.05) respectively.

Table 4.2 further indicates the relationship between the total flying hours the sample has and total pilot empowerment. Moreover, the results indicate there is no statistically significant relationship between the total flying hours and total pilot empowerment (r= -0.003, p> 0.05).

Table 4.2 also illustrates there is no statistically significant relation between the total flying hours the sample of pilots has and any of the pilot empowerment subsections. These subsections

are pilot authority, professionalism and peer culture (r=0.002, p>0.05; r= - 0.038, p>0.05; r=0.052, p>0.05) respectively. Therefore, hypothesis 1 is rejected claiming there is a statistically significant relationship between the years of experience pilots has as well as their total flying hours and pilot empowerment.

Hypothesis 2: A statistically significant relationship exists between management involvement and organisational commitment to safety.

Table 4.3: Pearson Correlation between Management Involvement and Organisational Commitment

Organisational Commitment								
	Subtotal: Management Attitude towards Safety		Subtotal: Proactive Safety		Subtotal: Safety Training		**Total: Organisational Commitment**	
	r	P	r	P	r	P	**r**	**P**
Management Involvement	0.308	0.001	0.299	0.002	0.280	0.004	**0.329**	**0.001**

r: Regression, P: Significance

Table 4.3 reveals there is a positive significant relationship between management involvement and the total organisational commitment (r=0.329, p<0.05). Furthermore, table 4.3 also reveals the same correlation exist between all management involvement and all three subsections of organisational commitment which are management attitude towards safety, proactive safety as well as safety training (r=0.308, p<0.05; r= 0.299, p<0.05; r=0.280, p<0.05). Hence, hypothesis 2 is accepted.

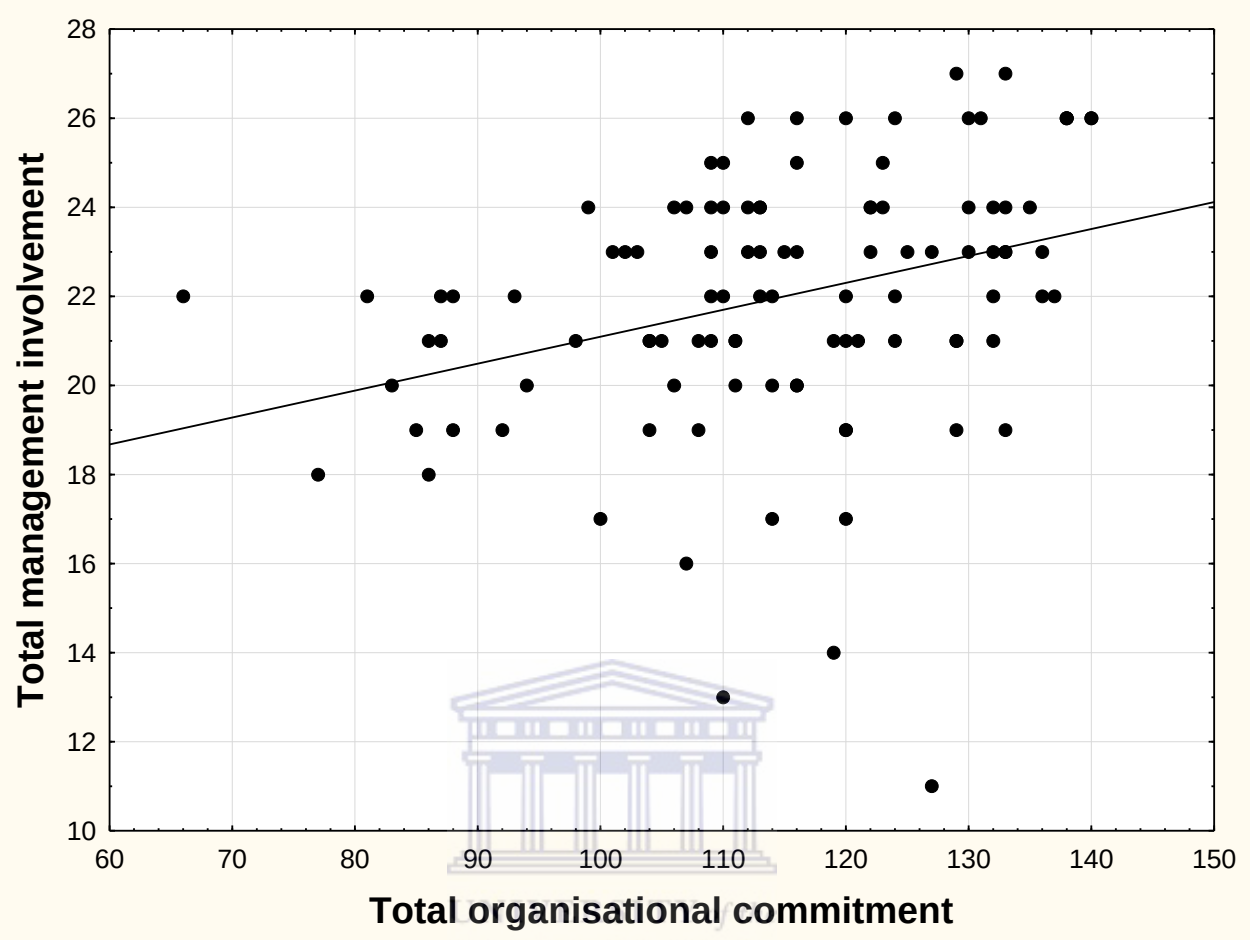

Figure 4.6: Scatter plot of total management involvement and total organisational commitment

The scatter plot above indicates a highly significant positive correlation between management involvement and total organisational commitment (total): r= 0.329; p = 0.001.

4.2.3 Results of the Anova Analyses

The third hypothesis of this study utilised Anova analysis and the results are presented below.

Hypothesis 3:

There is a statistically significant relationship between the rank of the professional pilot, organisational commitment, and pilot empowerment.

Table 4.4: ANOVA of organisational commitment to safety and pilot empowerment along with ranks of pilots

ANOVA						
	Rank	**N**	**Mean**	**+- Standard Deviation**		**P-Value**
Total Organisational Commitment to Safety	*First Officer* [a]	34	111.5	15.4		$P^{ab} = 0.142$
	Senior First Officer [b]	23	120.2	13.4		$P^{ac} = 1.000$
	Captain [c]	34	115.1	18.1		$P^{bc} = 0.730$
Pilot Empowerment	*First Officer* [a]	34	54.8	6.1		$P^{ab} = 0.815$
	Senior First Officer [b]	23	56.9	6.7		$P^{ac} = 1.000$
	Captain [c]	34	55.8	8.2		$P^{bc} = 1.000$

P: Significance

Table 4.4 indicates there is no significant mean difference between the pilots ranks, total organisational commitment to safety and pilot empowerment all to be greater than 0.05 ($p > 0.05$). Thus hypothesis 3 is rejected. However, the mean differences in both total organisational

commitment and pilot empowerment were highest for the Senior First Officers compared to First Officers and Captains.

The means for the rank and total organisational commitment were as follows: First Officer (Mean= 111.5, SD = ± 15.4), Senior First Officer (Mean = 120.2, SD = ± 13.4) and Captain (Mean = 115.1, SD = ± 18.1).

The means for the rank compared to total pilot empowerment were: First Officer (Mean = 54.8, SD = ± 6.1), Senior First Officer (Mean = 56.9, SD = ± 6.7) and Captain (Mean = 55.8, SD = ± 8.2).

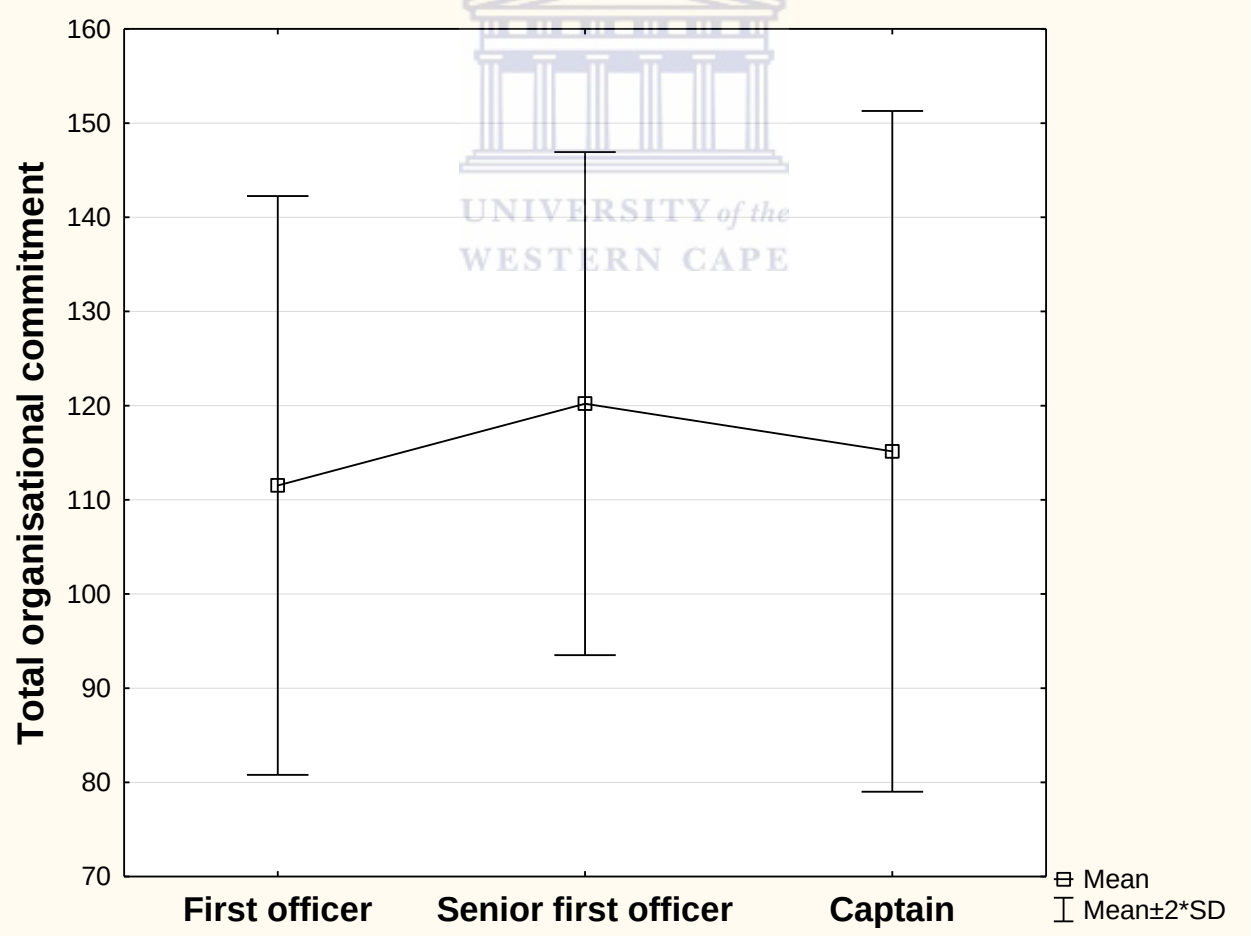

Figure 4.7: Mean distribution of total organisation commitment and ranks

Figure 4.7 provides a visual depiction of the results. As indicated above in the explanation, the Senior First Officers had the highest mean score for total organisational commitment.

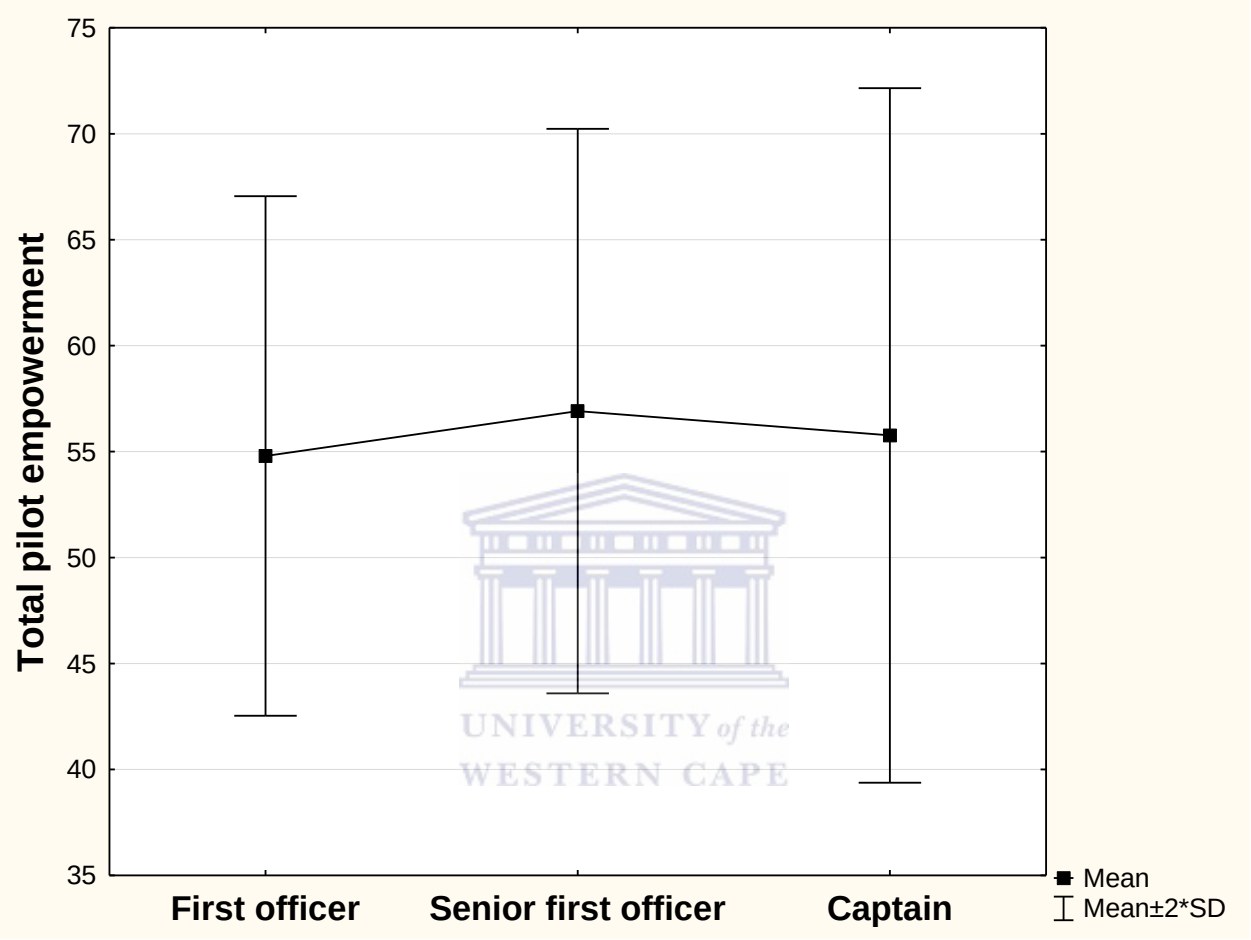

Figure 4.8: Mean distribution of total pilot empowerment and ranks

Figure 4.8 presents a visual depiction of the results indicating the mean distribution of total pilot empowerment and ranks. The visual depiction indicates the Senior First Officers had the highest mean score for total pilot empowerment.

4.2.4 Results of the Multiple Regression Analysis

Multiple regression was used to analyse the forth hypothesis and the results are presented in the following section.

Hypothesis 4:

Reporting systems, accountability systems, pilot empowerment and management involvement explain a significant proportion of the variance in organisational commitment, as part of safety culture amongst pilots.

Table 4.5 Multiple Regression Analysis depicting the association between total organisational commitment to safety and reporting systems, accountability systems, pilot empowerment as well as management involvement

N=104	**Multiple Regression Summary for Dependent Variable: Total Organisational Commitment to Safety** **Adjusted R^2 = 0.748** **F(4.99)= 77.566 p<0.001**					
	b*	**Std.Err. of b***	**b**	**Std.Err. of b**	**t(99)**	**P-value**
Intercept			5.540	7.373	0.751	0.454
Total Reporting system	0.328	0.074	1.153	0.260	4.441	< 0.001
Total Accountability Systems	-0.007	0.069	-0.044	0.458	-0.096	0.924
Total Pilot Empowerment	0.651	0.089	1.480	0.202	7.318	< 0.001
Total Management Involvement	-0.105	0.057	-0.568	0.311	-1.828	0.071

Table 4.5 depicts the multiple regression analysis which was done to predict total organisational commitment from reporting systems, accountability systems, pilot empowerment as well as

management involvement. The adjusted R^2 (0.748) indicates 74.8% strength in the model. The estimated strength of the relationship is between total organisational commitment and the response variables (total reporting system, total accountability system, total pilot empowerment as well as total management involvement). Furthermore, the relationship between total organisational commitment safety and the response variables (total reporting system, total accountability system, total pilot empowerment as well as total management involvement) is statistically significant where $F(4.99) = 77.566$, $p < 0.001$.

However, Table 4.5 indicates that only two of the four dimensions (total reporting systems and total pilot empowerment) is a significant predictor of total organisational commitment. With regards to the dimension of total reporting system, if it improves with 1 unit, the total organisation commitment will improve with 0.328 units, in this case this association is statistically significant ($p < 0.05$). The same association exist for total pilot empowerment, if it increases by 1 unit, the total organisation commitment will improve with 0.651 units, and in this case this association is also statistically significant ($p < 0.05$). Hence, Hypothesis 4 is accepted as there is a relationship between total organisational commitment and the dimensions of safety culture, with statistically significant beta values for reporting system and pilot empowerment.

4.3 Conclusion

This chapter provided an overview of the findings which was obtained from this research. The analysis were linked to the pre-formulated hypothesis and indicated whether the hypothesis was accepted or rejected. Both descriptive and inferential statistics were used in the analysis.

In the following chapter a discussion will be presented based on the results and furthermore recommendations on future studies relating to this one will be provided.

CHAPTER 5: Discussion, Limitations, Recommendations and Significance

5.1. Introduction

This chapter will provide a discussion based on the findings of this research study. Literature of previous studies will be incorporated in this discussion in order to conceptualize the findings. Furthermore, a conclusion will be provided based on the results of this research as well as recommendations for future research within the aviation industry, specifically relating to professional pilots.

5.2. Discussion of Results

5.2.1 Demographic Information

The sample of this population constituted of 104 professional pilot respondents from fifteen different South African based aviation organisations. The largest proportion of respondents were male (86.4%, n=88), along with the greatest portion of the total sample being white in ethnicity (57.7%, n=60). The ethnicity proportions were followed by black, Indian and coloured (18.3%, n=19; 14.4%, n=15 and 9.6%, n= 10) respectively. This information could indicate that the professional pilot population is male dominated, but specifically by whites within South Africa. Additionally, the vast majority of respondents were between the ages of 21-30 years of age (49%, n=51), with most of the respondents indicated to having 1-10 years of flying experience (58.7%, n=61). This could signify the younger professional pilots were more forthcoming to participating in this research rather than the older ones. Furthermore, the majority of the pilots were either Captains or Senior First Officers as the total of those two titles were equal (32.7%,

n= 34). For the professional pilot, the title of Captain is the highest rank followed by Senior First Officer.

5.2.2 Hypothesis 1

The first hypothesis was as follows: there is a statistically significant relationship between the flying experience pilots have and pilot empowerment.

Results from this study indicated there to be no significant relationship between total pilot empowerment or its subsections (pilot authority, professionalism and peer culture) with either years of flying experience or total flying hours.

The absence of any relationship between pilot empowerment as measured by subsections (pilot authority, professionalism and peer culture) and their experience as measured by years of experience and total flying hours may suggest that the training of pilots may be sufficiently thorough to enable good practice. However, Hoole and Vermeulen (2003) indicated that pilots are constantly challenged with continuous aviation developments, large amounts of aviation information and growth in their daily amount of flying in order to progress within their organisation. It seems certain types of pilots, such as airline pilots, does not have trouble with the constant changes as their job satisfaction level was quite high.

In a study conducted by Prince, Salas, Brannick and Prince (2010), which was within the cockpits of the military to determine the influence of experience and organisational goals on leadership, they found the significant difference to alter according to the situation between aircraft commanders and second pilots. For example: there was no significant difference when

the aircraft commanders commanded the second pilot in three situations, despite the second pilots' experience. However, during a problem solving phase the flight commander would differ in their approach to the problem, depending on the second pilot's experience. Furthermore Prince et al., (2010) found there was a significant difference in the manner which the second pilot commandeered the aircraft commanders based on experience level. Overall, the study discovered that differences in leadership exist when attributed to the pilots' experience level.

5.2.3 Hypothesis 2

The second hypothesis stated a statistically significant relationship exists between management involvement and organisational commitment.

The results of this study indicated there were highly significant positive correlations between management involvement and organisational commitment to safety as well as with the subsections of organisational commitment to safety (management attitude towards safety, proactive safety as well as safety training).

The significant relationship between management involvement and organisational commitment to safety suggested that management involvement is crucial to maintain organisational commitment to safety. It should not be surprising, in this case, that management involvement and organisational commitment to safety shows a positive correlation. This is because Wiegmann et al., (2002) indicates organisational commitment towards safety should be demonstrated and implemented from those at the highest level of the organisation. The commitment should be in the form of policies promoting safety as well as the allocation of resources towards safety.

Alsowayigh (2014) also found a significant positive relationship between management involvement and organisational commitment to safety. He emphasized the importance of management involvement on organisational commitment to safety. By having management allowing pilots to be involved in safety practices, responding to their safety concerns, providing them with the necessary authority to make safety related decisions, and appraising safety practices all contributes to the increase of organisational commitment towards safety.

5.2.4 Hypothesis 3

The third hypothesis explored whether there is a statistically significant relationship between the rank of the professional pilot, organisational commitment, and pilot empowerment.

The results of this research indicated no significant difference in total organisational commitment to safety as well as in total pilot empowerment when compared between pilot ranks. This strongly suggested that organisational commitment to safety and pilot empowerment are well distributed between all ranks. Moreover, this could be linked to the initial training pilots received as well as the Crew Resource Management (CRM) training they received from the organisation in order for them to conform towards their organisational culture. All pilots, no matter whether they are a junior or senior pilot, follow the standard safety practices within the aviation industry. However, in a study conducted by Gao, Bruce, Newman and Zhang (2013) to determine the effect of pilots rank and their experience level, they found a different result. Pilots of lower ranks, i.e. junior pilots, seemed to have a greater positive perception towards safety than their senior counterparts.

5.2.5 Hypothesis 4

The fourth hypothesis examined whether there was an association between reporting systems, accountability systems, pilot empowerment, management involvement and organisational commitment, as part of safety culture amongst pilots.

Reporting systems, accountability systems, pilot empowerment and management involvement explain a significant proportion of the variance in organisational commitment, as part of safety culture amongst pilots.

The hypothesis was accepted in this case as overall there was an association between reporting systems, accountability systems, pilot empowerment, management involvement and organisational commitment to safety.

Results showed that total pilot empowerment and total reporting systems explained the greatest proportion of variance in total organisational commitment towards safety. This means to enable organisational commitment to safety the pilot empowerment and reporting systems is of highest significance. This suggests that organisational commitment towards safety depends on pilot empowerment and reporting systems in order for top management to make strategic decisions with regards to safety. If top management does not trust pilots enough to utilise the reporting systems in recording accurate safety practices, their attitude towards safety would alter. This could lead top management to increasing their proactiveness towards safety and also increasing the safety training which they provide their pilots.

The accountability system and total management involvement did not indicate a statistically significant proportion of the variance in total organisational commitment, but these results should not be interpreted in isolation. Furthermore, management involvement and total organisational commitment indicated a highly significant positive correlation. This means that when the correlation between these two variables was done, other factors were not taken into account. A regression analysis was therefore done and indicated that certain co-variables were of higher significance, specifically management involvement. This suggests if an excess of need to management involvement arises it could be detrimental to safety practices of the organisation.

From the research which was conducted for this study, no safety culture studies conducted within the aviation industry was found which utilised multiple regression analyses. Hence, no empirical evidence was used in support of the multiple regression analysis conducted on the safety culture model within this study. However, a study with regards to the development and initial validation of a survey assessing a five aspect safety culture within commercial flight operations (Gibbons, Von Thaden & Wiegmann, 2006) slightly differed in comparison to the results of the current study. The five aspects of safety culture (including accountability systems, reporting systems, organisational commitment, pilot empowerment as well as management involvement) indicated a misfit of the original model construction. It was further suggested additional factors should be added or an alternative specification to the model would be necessary. Once items were revised on the original model and compared to the revised one a significant difference prevailed better than the original model.

Soon after, Ek and Akselesson (2007) conducted a study among baggage handlers within the aviation industry and utilized nine safety culture aspects (working situations, communication, learning, reporting, justness, flexibility, attitude towards safety, safety-related behaviours and risk perceptions). After carrying out a correlation between the safety culture aspects, they found all the aspects of safety culture to be positively and significantly inter-correlated.

5.3 Limitations of the Study

This study was conducted utilising the responses from professional pilots within the South African aviation industry. The foremost limitation of the study is that a non-probability sample was utilized in the research design. Although this sampling type was used to collect data conveniently, it limited the generalizability of the results across professional pilots within the South African aviation industry. Additionally, no conclusions could be made relating to gender as the pilot population is a dominated male industry. Although permission was obtained from fifteen different South African based aviation organisations to have their pilots participate in this research, due to the pilots' busy professional schedule, the response rate received from the pilots was deemed low. Within a period of five months constant follow-up were made with the organisations to communicate with their pilots, the responses rate continued to remain low.

5.4 Recommendations

From this research which was conducted a number of recommendations can be made for future research, in order to strengthen the body of research. When conducting research in the aviation industry, especially among pilots, it is high recommended to either employ a qualitative or mixed

method approach. The qualitative approach will assist the researcher with gaining more information in a short period of time as utilizing a quantitative approach among pilots can be time consuming, especially to the researcher. This is because, if the researcher is not in the industry, he or she would constantly have to follow-up with organisations in order to achieve results. A mixed method approach to collecting data would also be recommended as the quantitative data serves to support the qualitative data, and vice verse, when conclusions are drawn. Furthermore, it serves to strengthen the overall research conducted. Additionally, linking onto this, it is imperative to have aviation organisations' full commitment and buy-in when conducting research within the South African Aviation industry in order to better current aviation practices. This is because little research has been conducted within this field.

With regards to the sampling procedure, a probability sampling approach with an acceptable sample size is suggested for future research. This is because it allows for the results to be generalizable.

Another recommendation would be based on one of the factors of safety culture, organisational commitment. The traditional definition of organisational commitment refers to individuals' psychological attachment towards the organisation they are employed at (Allen & Meyer, 1990; Gasic & Pagon, 2004; Jung-Cheng, Wen-Quan, Zhao-Yi & Jun, 2015). However, the definition of organisational commitment within safety culture refers particularly to the practices of the top level management within the organisation (Zhang et al, 2002; Von Thaden & Gibbons, 2008). The definition of organisational commitment within safety culture could easily create confusion to a reader especially if the reader is familiar with the traditional definition. It is therefore

recommended that the definition of organisational commitment within safety culture be altered towards one that eliminates confusion towards readers as well as future researchers.

In a safety culture study conducted within the railway industry, on maintenance personnel, it was found that forty primary factors influences the organisation's safety culture as well as that of the safety behaviour of workers on the rail tracks (Farrington-Darby, Pickup, & Wilson, 2005) . From this, safety culture seems to have various influences depending on the industry it is in. Hence, it is recommended that a safety culture study be conducted within different industries simultaneously in order to compare the various influences on safety culture within the different industries.

5.5 Significance of this Study

This chapter discussed the results of this research, especially with regards to each hypothesis. Literature was used to either support the findings or indicate a different result from in previous research. Furthermore, recommendations were presented in order to improve future studies among pilots within the aviation industry.

The aim of the research was conducted in order to assessing safety culture among professional pilots within selected South African based aviation organisations. From the research which was collected, it was discovered that little to no studies of this nature, assessing safety culture of professional pilots, have been conducted within South Africa. This study employed the safety culture model proposed by Gibbons, Von Thaden and Wiegmann (2006). During this study, factors of the safety culture model were correlated in order to discover whether significant

relationships exist. The results indicated a majority of the participants had responded positively towards the items indicating there to be a healthy safety culture within the selected South African aviation organisations. However, the safety culture model factors were not only correlated with each other but also with certain demographic information such as the years of flying experience, total flying hours as well as the rank of the pilots.

Overall, four hypothesis were formed in this study of which only two were accepted. The first significant relationship was found between total organisational commitment and management involvement. Additionally, the other significant relationship was found between the five factors of safety culture when organisational commitment was used as a dependent variable. Furthermore, the two hypotheses which were proven to not have a significant relationship contained demographic factors. The first of the two, investigated the relationship between flying experience and pilot empowerment. And the second of the two investigated the relationship between the rank of the pilots', organisational commitment as well as pilot empowerment.

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Appendix A: List of Questions

List of Questions

Organisational Commitment

Management's attitude toward safety

My company's safety practices are consistent with published corporate values and mission

Management is willing to invest time money and effort to improve airworthiness and operational safety

The management of my company is approachable about safety concerns

Safety in this organization is largely due to adherence to the standard operating procedures

Any regulatory violations are viewed very seriously by management, even when the violation does not cause any evident damage

Our management climate promotes adherence to the highest possible safety standard

Safety in this organisation is largely due to our collective commitment to safety

Proactive safety

People in this airline would rather cancel/postpone a flight due to safety concerns than take a chance.

The maintenance of the aircraft is done in a professional manner and is held to high safety standards in order for the aircraft to operate at its best.

My company has clearly defined flight and duty limits.

The standard operating procedures at the airline I work for is up-to-date.

The operations and checklists of the airlines are simple to comprehend.

Safety Training

The company offers pilots annual safety training and safety evaluation

The safety aspects of the airline are accentuated, during the interview and orientation process.

Safety is accentuated during training practices

My company has a program that addresses safety training deficiencies

Reporting System

My airline has an adequate reporting system in which all safety concerns can be addressed.

Management issues are also examined during the investigation of significant safety occurrences.

Unapparent mistakes are not reported by the pilots themselves.

I understand the procedures of formally reporting safety concerns to the airline I work for.

The safety program contains methods for me to inform the airline about safety deficiencies.

Anonymity is the best way when reporting unsafe conditions or incidents

Pilots can report safety discrepancies without having negative repercussions

Management moves decisively to correct any safety issues a pilot has reported.

I am encouraged by my supervisors and co-workers to report any unsafe conditions I may observe

Accountability System

Negative repercussions are taken against pilots who breach safety procedure or rules

Whether it is in the best interest of the airline that is by saving money or time, pilots can still be held accountable for acting unsafely.

The process taken to investigate possible unsafe behaviour of pilots is fair.

Accountability standards are constantly applied to all pilots in my airline

Pilot Empowerment

Pilot's Authority

Pilots are comfortable approaching management about personal problems/illness

My managers ask my opinion before making decisions that affect the safety of my work

Within my organization, good communication flow exists up and down the organization chain of command

Professionalism

I am encouraged to stop flight related activities that are unsafe.

To fly safely is significant for me to keep the respect of other pilots in the airline company.

Safety is my responsibility

The people that I work with comply with the company's standard operating procedures

I am proud to work for this company

I am aware of my company's mission, values, and core ideology

My company is the "best in the business"

Peer Culture

A pilot who stops a flight because of a concern about safety or airworthiness is always supported by other pilots

Influences by co-workers are effective at discouraging breach of standard operating procedure and flying regulations.

Everyone routinely performs the operational checks after the work is completed

I trust my colleagues to choose safety over performance, regardless of my performance

Management Involvement

Management expects pilots to continue flying regardless of unsafe weather conditions.

Chief pilots get personally involved in safety activities

Chief Pilots do not hesitate to contact pilots to discuss safety issues.

The chief pilot protects confidential or sensitive information

I trust my chief pilot to choose safety over performance

My suggestions about safety would be acted upon if I expressed them to my chief pilot

Appendix B: Cover Letter

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August 2015/September 2015

DEPARTMENT OF INDUSTRIAL PSYCHOLOGY

Dear Captain/ / First Officer,

This questionnaire is designed to study aspects of Safety Culture of South African Professional Pilots. The information you provide will help us better understand the quality of Safety Culture within the South African Aviation Industry. Because you are the one who can present us with a correct picture of how you experience Safety Culture, we request you to respond to the questions frankly and honestly.

Your response will be kept strictly confidential. Only members of the research team will have access to the information you provide. In order to ensure the utmost privacy, we have provided identification numbers for each participant. This number will be used by us only for follow-up procedures. The numbers, names or the completed questionnaires will not be made available to anyone other than the research team. A summary of the results will be mailed to your organisation after the data is analyzed.

Thank you very much for your time and cooperation. We greatly appreciate your help in furthering this research endeavour.

Cordially,

Miss A Davids,
M.Com Student (Intern Industrial Psychologist)

Mr K Heslop,
Academic Supervisor (Industrial Psychologist)

Appendix C: Questionnaire

Questionnaire

Study : Assessing Safety Culture of Professional Pilots within South African Based Aviation Organisations

You are hereby kindly being asked to participate in a survey to provide the researcher with information that will contribute to the study currently being conducted.

Participation in this survey is voluntary and confidentiality is assured. No individual data will be reported.

The questionnaire consists of TWO Sections.

Section A: This consists of biographical details of the respondent

Section B: This consists of the 49 questions relating to Safety Culture

Read the specific instructions and then answer **ALL** the questions following the instructions as truthful as possible.

Instructions:

The following should be taken into account as a general guideline when answering the questions:

1. Do not ponder over the questions for too long- read it and indicate the first reaction that comes to mind spontaneously
2. Make sure that you do not skip questions. Some questions may perhaps seem very personal, but remember that your answers will be treated strictly confidential.
3. There is no "right" or "wrong" answers. The best results will be obtained when you indicate your true feelings.

Signature: _____ Date: _____

Section A: Biographical Information

Please mark the appropriate box with a cross [x]

1. Job title: ☐ Captain ☐ F/O ☐ S/FO

2. Gender: ☐ Male ☐ Female

3. Ethnicity: ☐ White ☐ Black ☐ Coloured ☐ Indian ☐ Other

4. Age in years: _____

5. Highest educational qualification in addition to flying qualification:

☐ High School ☐ Masters ☐ Undergrad ☐ PhD ☐ Honours

6. Home Language: ☐ English ☐ Afrikaans ☐ Xhosa ☐ Zulu ☐ Other

7. Flying Training: ☐ Private School ☐ Cadet Programme ☐ Military ☐ Other

8. Total years of flying experience:_____

9. Total flying hours:_____

10.Base(Geographical location you stationed at) :_____

11. Current operating fleet qualifications:_____

Section B: Safety Culture

Rate each of the following questions on a scale of 1 to 5, giving a 1 to items that you strongly disagree with and 5 to items you strongly agree with. Please indicate your chosen option with a cross [X]

	1 (Strongly disagree)	**2** (Disagree)	**3** (Neutral)	**4** (Agree)	**5** (Strongly Agree)
1. Everyone routinely performs the operational checks after the work is completed.					
2. I am aware of my company's mission, values, and core ideology.					
3. Safety is my responsibility.					
4. Safety is accentuated during training practices.					
5. My company has a program that addresses safety training deficiencies.					
6. My company's safety practices are consistent with published corporate values and mission.					
7. Management is willing to invest time money and effort to improve airworthiness and operational safety.					
8. Safety in this organisation is largely due to our collective commitment towards safety.					
9. My company has clearly defined flight and duty limits.					
10. The process taken to investigate possible unsafe behaviour of pilots is fair.					
11. Pilots are comfortable approaching management about personal problems/illness.					
12. I am encouraged to stop flight related activities that are unsafe.					
13. Chief Pilots do not hesitate to contact pilots to discuss safety issues.					
14. I trust my chief pilot to choose safety over performance.					
15. My managers ask my opinion before making decisions that affect the safety of my work.					
16. Unapparent mistakes are not reported by the pilots themselves.					
17. Pilots can report safety discrepancies without having negative repercussions.					
18. Accountability standards are constantly applied to all pilots in my airline.					
19. I am proud to work for this company.					

	1 (Strongly disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
20. I trust my colleagues to choose safety over performance, regardless of my performance.					
21. My suggestions about safety would be acted upon if I expressed them to my chief pilot.					
22. Anonymity is the best way when reporting unsafe conditions or incidents.					
23. My airline has an adequate reporting system in which all safety concerns can be addressed.					
24. A pilot who stops a flight because of a concern about safety or airworthiness is always supported by other pilots.					
25. I am encouraged by my supervisors and co-workers to report any unsafe conditions I may observe.					
26. People in this airline would rather cancel/postpone a flight due to safety concerns than take a chance.					
27. The management of my company is approachable about safety concerns.					
28. I understand the procedures of formally reporting safety concerns to the airline I work for.					
29. Chief pilots personally get involved in safety activities.					
30. Management moves decisively to correct any safety issues a pilot has reported.					
31. The standard operating procedures at the airline I work for is up-to-date.					
32. Safety in this organization is largely due to adherence to the standard operating procedures.					
33. Negative repercussions are taken against pilots who breach safety procedure or rules.					
34. The safety program contains methods for me to inform the airline about safety deficiencies.					
35. Within my organization, good communication flow exists up and down the organization chain of command.					
36. My company is the "best in the business".					
37. Management expects pilots to continue flying regardless of unsafe weather conditions.					
38. The chief pilot protects confidential or sensitive information.					
39. The people that I work with comply with the company's standard operating procedures.					
40. Whether it is in the best interest of the airline, which is by saving money or time, pilots can still be held accountable for acting unsafely.					

	1 (Strongly disagree)	2 (Disagree)	3 (Neutral)	4 (Agree)	5 (Strongly Agree)
41. The company offers pilots annual safety training and safety evaluation.					
42. Influences by co-workers are effective at discouraging breach of standard operating procedure and flying regulations.					
43. The safety aspects of the airline are accentuated, during the interview and orientation process.					
44. The maintenance of the aircrafts is done in a professional manner and is held to high safety standards in order for the aircrafts to operate at its best.					
45. Any regulatory violations are viewed very seriously by management, even when the violation does not cause any evident damage.					
46. Our management climate promotes adherence to the highest possible safety standard.					
47. Management issues are also examined during the investigation of significant safety occurrences.					
48. To fly safely is significant for me to keep the respect of other pilots in the airline company.					
49. The operations and checklists of the airlines are simple to comprehend.					

End of Questionnaire