CRANFIELD UNIVERSITY

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EVALUATION OF THE CONCEPT OF CRIMINALISATION OF HUMAN ERROR IN AVIATION IN THE MIDDLE EAST

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School Of Aerospace, Transport And Manufacturing

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Supervisors: Professor Graham Braithwaite
Doctor Jim Nixon

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“Submitted in partial fulfilment of the requirement for the degree of Doctor of Philosophy.”

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ABSTRACT

Aviation is one of the safest modes of transportation, due to the high standards and regulations that govern this industry. One of the methods that enhance aviation safety is accident and incident investigation, where root causes and contributing factors are analysed to generate safety recommendations that assist in the prevention of future, similar accidents. However, there has been an increasing trend of criminalising aviation professionals in the wake of aviation accidents where aviation accident investigators were also invited to testify as experts to help judges deliver justice for affected parties.

The research was conducted over 9 phases starting with a literature review, exploring the issues surrounding the concept of the criminalisation of pilot error in the aviation industry. From there knowledge gaps were identified and research questions generated from them. To fill these gaps a questionnaire was developed and field studies and online surveys were conducted to gather data, which was used to generate an initial framework which was subsequently evaluated using subject matter experts (SMEs) and hypothetical case studies to validate them. The results of the evaluation and validation were then used to generate the final Criminalisation of Pilot Error (CoPE) framework for use in the aviation industry that helps to guide independent safety investigators to address and prevent the escalation of pilot error cases from reaching the court.

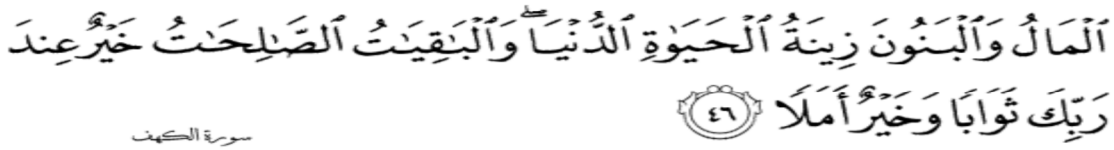
The research also created well-defined elements that cover all aspects of the criminalisation of pilot error, as well as, a detailed study addressing cultural aspects in different parts of the world, with a focus on the Middle East, and how these affect the concept of the criminalisation of pilot error.

DEDICATED TO

My beloved mother and father

“And lower unto them the wing of submission through mercy, and say: My Lord! Have mercy on them both as they did care for me when I was little.” (Quran42:71)

My Son



“Wealth and sons are allurements of the life of this world” (Quran: 46)

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LIST OF ABBREVIATIONS

AAIB	Air Accidents Investigation Branch
ADR	Alternate Dispute Resolution
BEA	French Investigation Bureau
CAA	Civil Aviation Authority
CCA	Court of Conciliation and Arbitration
CG	Centre of Gravity
COPFS	Crown Office and Procurator Fiscal Service
CoPE	Criminalisation of Pilot Error
CPS	Crown Prosecution Service
CVR	Cockpit Voice Recorder
DFDR	Digital Flight Data Recorder
EASA	European Union Aviation Safety Agency
ENCASIA	European Network of Civil Aviation Safety Investigation Authorities
EU	European Union
FBI	Federal Bureau of Investigation
HPD	High Power-Distance
ICAO	International Civil Aviation Organization
LPD	Low Power-Distance

MoU	Memorandum of Understanding
NTSB	National Transportation Safety Board
PACT	Professional Arbitration on Court Terms
UK	United Kingdom
USA	United States of America

1 INTRODUCTION

1.1 Research Rationale

The aviation industry has undergone much improvement, which has reduced the accident rate, and is continuing to evolve due to the analysis of accident and incident reports. However, technological and legal developments have led to the perception that this industry is error-free, so, in the wake of aviation disasters, aviation professionals are prosecuted for committing or omitting specific actions that may have contributed to the accidents. Even though such actions were unintentional, the courts have also been observed to issue harsh sentences to satisfy their alleged purpose of ensuring justice (Dekker, 2011; Flight Safety Foundation, 2006; Michaelides-Mateou and Mateou, 2016; Winter et al., 2020)

1.1.1 Research Questions

The literature survey, which is included in chapter 2, was conducted to identify research questions. Those questions cover the areas where research gaps were found, were then transformed into questions, and those questions are as follows;

1. What is the judiciary law that applies to the criminalisation of pilot error in the aviation sector?

Globally, there is no unified law that applies to pilots to address the criminalisation of pilot error. For example, the outcomes of pilot errors could have different consequences if they occur in various nations, with different judicial systems; in the United States, passengers have pursued compensation due to injury caused by unexpected air turbulence while the seat belt sign was switched off. In other countries, affected passengers cannot do this since it is out of the pilots' control, and they cannot be held liable for it.

2. What are the key factors that influence pilot error during the course of their duties?

The factors that influence pilot error are multi-fold; however, they have neither been explained nor detailed in previously published literature. Therefore, it is crucial to address such influential factors, and to develop a comprehensive list of them.

3. Is there agreement regarding the cultural aspects that influence pilot error in the aviation sector?

People, by nature, are different; depending upon the region they grew up in, or the nation they belong to, their culture and tradition evolve. Culture is a vast topic, which researchers have divided into different categories. Based on previous research done by Hofstede (2001), culture has been broken down into several traits. For the purposes of this research, only power-distance will be addressed. According to previous research, power-distance (PD) is essential and differs significantly by region. For example, in the United Kingdom, questioning authority is not considered disrespectful, as opposed to the case in Far-Eastern cultures.

4. What are the key elements that cover all aspects of the criminalisation of pilot error?

Several elements are mentioned in the literature; however, a comprehensive list is needed to cover all aspects surrounding the criminalisation of pilot error. Unfortunately, the trend of the criminalisation of pilot error is increasing. Therefore, it is important to address such elements and investigate them thoroughly in order correctly guide safety investigators on how to tackle this issue.

1.1.2 Research aim

The aim of this is paper is the formulation of the concept of criminalisation of pilot error (CoPE) from the stakeholders perspective, and to develop an international systematic approach that deals with CoPE in the wake of accident investigations, using statistical methods to validate such an approach. The term pilot error is one of the elements of human factors, which is a very general term; therefore, in this research the focus will be on this element of human factors.

1.1.3 Research objectives

a. To have a sound understanding of the background theory of the criminalisation of human error in the aviation sector via extensive literature review.

b. To perform a field study to obtain the perspective of the aviation industry on human error.

c. To define the elements that constitute the criminalisation of human error in the aviation sector based on the analysis of the collected data.

d. To develop a framework of the criminalisation of pilot error in the aviation sector.

e. To validate the developed framework via case studies and evaluate it via expert judgment.

1.1.4 Research Gaps

A review of the relevant literature suggests a gap in the aspects surrounding the concept of criminalisation. Thus, the aim of the research is to evaluate the effects of the criminalisation of human error, and its subsequent punishment in the aviation industry. As referred in chapter two, the following studies suggest that research gaps exist in the following areas. These are the main studies identified in the literature survey of the published literature to date.

1- The study of Yi et al., (2015) provides an example of a Low Power-Distance (LPD) culture versus a High Power-Distance (HPD) culture. Moreover, the conclusions of this study supported older studies (Murphy, Gordon and Anderson, 2004; Robbins, 2001). This suggests the possible applicability of such a study in the research on the influence of the perception of the concept of criminalisation on LPD versus HPD cultures.

2- The research also suggests that a correlation exists between the accident rate and cultural factors of individualism and Power-Distance (PD), which was also visible in other accidents, such as the Avianca 052 and Korean 801 (Chow, Yortsos and Meshkati, 2014; Gladwell, 2008).

3- This study takes a critical step towards establishing the view that the safety culture is empirically correlated to safety performance (Morrow, Kenneth and Barnes, 2014).

4- Lewis et al. (2011) conducted a study in which aviation safety aspects were applied in the medical field. The conclusions of this study showed that there was resistance to change within the culture, but that this may improve over time and these changes might become acceptable, as supported by the study of Sax et al. (2009). In this study, a slight change in culture was observed over a few years, following the application of crew resource management in the medical field. Consequently, it is possible to influence culture; hence, culture is on-going and could be influenced by different external and internal factors. Therefore, the introduction of the criminalisation concept may have an influence on the safety culture within organisations, the impact of which should be examined.

5- The study of Al-Wardi (2017) concluded that national culture plays an important role in the human factors related to aviation accidents. The relationship was developed using a cross-cultural comparison conducted between three countries: Oman, Taiwan, and the USA. The data obtained from the accident investigation reports were classified using the HFACS system.

Based on the above studies the above research questions were derived in section 1.1.1.

Based on the literature survey conducted, which is included in chapter 2, the following research gaps were identified. The topics researched were those topics surrounding the concept of criminalisation of pilot error, since there is a very limited number on this topic. The below areas cover the aspects to criminalisation of pilot errors, and are as follows;

1. No judiciary law specifically addresses criminalisation of human error in the aviation sector.

   Refer to paragraph 2.4.1 under the law it stated that Civil Law countries, judicial investigation have more control over safety. This normally only applies to accidents involving the death of a citizen of that country. There

are lengthy procedures that need to be observed; the result is usually that victims of the incident receive compensation.

Similarly, in paragraph 2.4.2, Common law countries still do not have a specific judiciary law for human error in the aviation sector. The UK for example, has two separate investigations, which are not clearly aimed at the human error aspects of aviation. The law as it stands has been set primarily to establish which person or persons are at fault. Therefore a specific jurisdiction needs to be introduced for only the human error aspect of the aviation sector, as it can include many factors other than just manslaughter.

2. There is no comprehensive study that compiles all the key factors that influence pilot errors during their duty.

   Under section 2.3.1 it clearly shows that there is no specific study which outlines the entire key factors that influence pilot errors during their duty. However, there are general factors about human errors as shown in section 2.3.

3. There is no explicit agreement of the cultural aspects that influence pilot error in the aviation sector.

   Section 2.3.4shows the culture that can be adopted in the aviation industry (such as safety culture), which is suitable for managing accidents and their consequences. There is also the concept of culture, principle of fear, bullying and secrecy. However, it is difficult to obtain an accurate record of the number of criminal cases in the aviation sector, which cannot distinguish a clear agreement from this.

4. There is a lack of distinct elements that cover all aspects of the criminalisation of pilot error.

   Section 2.5.1 explains the criminalisation in the aviation sector as a general approach of the crew performance and did not specify a pilot

aspect of criminalisation at all. Therefore, a distinct element that covers all aspects of criminalisation aimed specifically on pilot errors is required.

The trend of criminalising human error is increasing across the different industries. A review of the relevant literature suggests that a research gap exists regarding the factors that influence people's perceptions of criminalisation. Therefore, this research will examine the different factors that influence the perception of criminalisation, including the influence on crew performance, the punitive safety culture, Low Power-Distance (LPD) verses High Power-Distance (HPD) cultures, and the different legal systems.

The first phase is a literature review, which is conducted to explore the issues surrounding the concept of the criminalisation of pilot error in the aviation industry. Phase 2 entails the identification of research gaps, which also introduces the research questions. Phase 3 involves the development of a questionnaire using the literature review. To deliver answers, a field study is most suitable; online surveys (phase 4), and focus groups (phase 5), were conducted. Phase 6 uses data gathered during phases 4, and 5 to develop the initial framework for the Criminalisation of Pilot Error (CoPE). Phase 7 aims to evaluate the effectiveness and applicability of the CoPE framework by conducting interviews with Subject Matter Experts (SMEs) in the aviation industry. In Phase 8, hypothetical case studies were applied to validate the CoPE framework by simulating its practical applicability. Phase 9 involves the generation of the final CoPE framework.

Chapter two of this thesis contains a review of the relevant literature (phases 2 and 3), which helped to identify and consolidate the research gaps. The methodology is identified and explained in chapter three (phases 4 and 5), with its different stages, including the pilot study followed by the dissemination of the online questionnaire, the focus group, and the development of the CoPE framework. Chapter four contains the analysis (phases 6, 7, 8, and 9). Validation, which is also included in chapter four, consists of two stages: the Subject Matter Expert (SME) interviews, followed by the case study validation.

2 LITERATURE REVIEW

2.1 Introduction

Conducting a literature review is crucial in academic research and should accomplish the following aims: to provide an overall understanding of the researched subject, identify the relevant terminology and classifications, avoid replicating other research, define suitable methodological approaches, and determine the main gaps in previous studies in the same field (Creswell, 2014; Xiao and Watson, 2019).

The literature review was conducted to explore the issues surrounding the concept of pilot error in the aviation industry. The search included the following keyword formations in the article titles, abstracts and keywords as follows:

- (“Air Accident” AND “Human Error”)
- (“Aviation Safety” AND “Human Factors”)
- (“Criminalisation” OR AND “Human Error”)
- “Pilot Error”

The keyword search was conducted across four academic databases: EBSCO, ProQuest, Scopus and Thomson. The different search combinations were used to filter the most relevant papers and prevent an overload of search results. The keyword search strategy identified over 4,000 documents in English from the four academic databases, with a customised date range from 2005 to 2020 to identify the most recent studies. However, the researcher included a few older references, as these are necessary to support the new findings.

2.2 Culture and the dimensions of Hofstede

Aviation accident investigation has usually been associated with bio-psychological characteristics such as visual capabilities (Al-Wardi, 2017; Hawkins and Orlady, 1993) but, in the last few decades, the role of human behaviour has gained popularity in the sphere of risk control and accident investigation. Previous research shows a clear relationship between aircraft

accident rates and national culture (Helmreich and Merritt, 2001; Jing, Lu and Peng, 2001; Li, Harris and Chen, 2007; Tear et al., 2020). According to Hofstede (Hofstede, 2001; Mariani and Predvoditeleva, 2019; Minkov, 2018), these idiosyncrasies can be explained based on four categories: power-distance, individualism, masculinity and uncertainty avoidance. To provide more clarity in this area, Al-Wardi (2017) conducted a cross-cultural comparison between Oman, Taiwan and the USA. The study applied the Human Factors Analysis and Conclusions (HFACS), a tool that has been demonstrated to be useful previously in both military (Li and Harris, 2013; Wiegmann et al., 2005) and civil (Ergai et al., 2016; Gaur, 2005; Goh and Wiegmann, 2001) aircraft investigation, to identify the cause-effect relationships. The study concluded that national culture can have an impact on accident rates, but caution is advised because the HFCAS, invented in the USA, may include, within itself, a type of cultural bias.

In particular, power-distance, a dimension that defines the power distributed among a group of working individuals (Hofstede, 2001; Minkov, 2018), has been found to be more linked to accidents than other dimensions, such as masculinity.

The topic has been vigorously considered by academia; some authors have argued that there is a strong relationship between High Power-Distance (HPD) cultures and accident rates (Al-Wardi, 2017; Harris and Li, 2008; Michaelides-Mateou and Mateou, 2016; Soeters and Boer, 2009; Tear et al., 2020). Harris and Li (2008) proved that the African and Asian regions, regarded as having HPD, have five times more aircraft accidents than America and Europe, regarded as having LPD. Furthermore, the study demonstrated that, in Africa and Asia, one recurrent factor in the accident rates are failures regarding poor Crew Resource Management (CRM), whereby there is a 30 to 40-fold increased likelihood of errors occurring in decision-making, perceptual errors, and violations of procedures (Wiegmann and Shappell, 2003). The reason for this increment could be that HPD nations consider questioning their superiors as

disrespectful; the relationship between managers and workers is formal and, sometimes, communication is restricted (Harris and Li, 2008).

Accident rates differ across the globe; Asia and Africa generally experience more accidents than Europe and North America do (Arnaldo Valdés and Gómez Comendador, 2011; Harris and Li, 2008; Kharoufah et al., 2018). Such a difference is usually attributed to a failure within Crew Resource Management (CRM). Those continents host high power-distance (HPD) cultures, a dimension that defines the power-distributed among a group of working individuals (Hofstede, 2001; Tear et al., 2020), in which questioning superiors is considered disrespectful, leading to power-distance.

This apparent relationship between HPD cultures and accident rates was identified previously by Michaelides-Mateou and Mateou (2016). To illustrate, the judicial investigation of the Garuda B-737-400 accident in 2007 proved that the first officer warned the commanding captain several times about the unstable approach and suggested that they should commence a go-around, but failed to take the controls, a situation that later lead to the first officer's prosecution. The first officer was prosecuted because he failed to take the controls from the captain and perform the go-around for un-stabilized approach (NTSC, 2007). Similarly, the influence of an HPD culture was also visible on the Russian pilots of the Tu-154 Russian airliner, where the TCAS resolution advice was ignored since it contradicted the controller's instruction, which subsequently caused a mid-air collision near Uberlingen, Germany (Aerocontrol Switzerland. Trans. and Ladenbauer, 2007; Michaelides-Mateou and Mateou, 2016). Another clear example that supports the significance of the HPD cockpit in contributing to accidents is the Asiana airlines accident at San Francisco's international airport, where South Korean culture, which is considered HPD, played a role in the sequence of events leading up to the accident (Chow, Yortsos and Meshkati, 2014).

There are a few other cases that are noteworthy as examples of the criminalisation of pilot error.

a- The Linate airport accident; the accident occurred on Oct. 8, 2001, after a Scandinavian Airlines System plane (bound for Copenhagen) and a business jet crashed in morning fog on the Linate tarmac. The airport's ground radar was out at the time. The accident killed 110 people on the MD-87 plane, 4 people on the Cessna business jet and 4 members of the ground staff. Following the judicial investigation and litigations, four controllers were criminalised. They were convicted with multiple manslaughter and were sentenced to serve prison time. Looking deeper into the events that lead into the accident, those controllers were merely the last line of defence. Had the airport had a fully functional ground radar, as well as Low Visibility Procedures (LVP), this accident could have been totally preventable. Since, the deeper investigation does not abort direct blame into specific people, the court elected to choose people to serve its intended purpose of justice, fuelled by the media and the general public (New York Times, 2005; Solomon and Relles, 2011; Winter et al., 2020).

b- The Helios accident; on 14 August 2005, a Helios Airways B 737-300 on its way to Prague, via Athens, crashed into the highlands of Grammatiko, killing all 121 passengers and aircrew aboard the airplane. The airplane left Larnaca, Cyprus, at 09:07 and was cleared to climb to FL340. As the airplane climbed through 16,000 feet, the captain communicated with the company maintenance centre and informed them about a take-off configuration cautionary and air-conditioning system issues (AAIASB, 2006). One hundred and nineteen duties of manslaughter and affecting death through an irresponsible, careless and hazardous act were trialled in the Nicosia District Criminal Court against the chairman of the panel of executives, the CEO of Helios, the chief pilot, the general director of Helios, the operations director and the airline. In February 2010 the Greek court, regardless of the fact those individuals as well as the Helios airlines as a legal entity were previously on trial at the Nicosia Criminal Court, continued with charges against those persons but also incorporated

the two mechanics. It is the first case in which criminal trials in two jurisdictions were initiated against aviation experts in the wake of an air accident (AAIASB, 2006; Michaelides-Mateou and Mateou, 2016).

c- The Air France 447 accident happened in 2009 when an Airbus A330 stalled and smashed into the Atlantic Ocean, killing everyone on board. Following a major inquiry, it was established that the accident resulted from a chain of events that commenced when the autopilot disconnected after the airplane's Pitot tubes froze in thunderstorm weather over the ocean. The outcomes put scrutiny on the aircrew's consequent absence of awareness of what was going on and of what procedure was necessary, and their failure to control the airplane. This research debates that this is inappropriate, instead proposing a systems layered view that can be used to establish how systems, not people, lose situation awareness. This is established via a disseminated situation awareness-based explanation of the happenings leading to the accident. The conclusions establish that it was the sociotechnical system encompassing crew, cockpit and airplane systems that lost situation awareness, rather than the crew alone. However, the manufacturer, and Air France were sued for being responsible for the accident (Kharoufah et al., 2018; Salmon, Walker and Stanton, 2016).

d- Another incident that resulted in the Captain taking criminal charges was British airways Boeing 747 at London Heathrow. The flight was arriving from Bahrain in November 1989; during the final approach in Auto-land "fully automated approach" it deviated from the localizer, which is the lateral guidance, and due to poor visibility the crew elected to perform a missed approach and the airplane cleared a nearby building by approximately 12 feet. In the aftermath of this investigation the captain was criminally charged and was banned from operating commercial airplanes, even though there were many other contributing factors such as the Auto-land procedures for the B-747-

136, the sick first officer, and the deteriorating weather conditions (Connett, 1992).

e- On 2 June 1994, a Chinook helicopter of the Royal Air Force (RAF), collided on the Mull of Kintyre, Scotland during poor visibility conditions. The accident caused the deaths of all twenty-five travellers and four aircrew on board. Amongst the travellers were the United Kingdom's senior Northern Ireland intelligence specialists. This accident is the RAF's worst peacetime tragedy. In 1995, an RAF board of inquiry established that it was problematic to establish the exact reason of the incident. This decision was afterward reversed by senior investigating officers, who said the pilots were guilty of gross negligence. This assumption demonstrated to be debatable, particularly considering the abnormalities and technical problems surrounding the then new Chinook, which were afterwards uncovered. A Parliamentary investigation conducted in 2001 recognised that the earlier judgement of gross negligence was 'unjustified'. In 2011, an independent investigation of the accident cleared the crew of negligence (Campbell, 2004).

f- Another accident in New Zealand in 1979, Air New Zealand Flight 901; the initial investigation established that the accident was originated by pilot error, but public pressure directed the establishment of a Royal Commission of Inquiry into the accident. The commission found that the accident was caused by a modification done on the coordinates of the flight path the night before the accident, along with the failure to advise the pilots of the changes. The flight path was instead redirected to a route toward Mount Erebus. The investigation report blamed Air New Zealand. The accident is New Zealand's worst peacetime disaster, as well as the worst accident in the history of Air New Zealand (Brady, 2011; Furborough, 2011).

Yi et al. (2015) conducted a study on the influential factors regarding work-related attitudes between China and the US, in which it was found that attitudes towards careers differed. Influenced by national culture, the surveyed Americans demonstrated a more positive self-image than did the Chinese, whereby the surveyed Chinese had fewer expectations of their managers and demonstrated a greater interest in improving and changing their career compared with their counterparts in the US. This provides an example of a LPD culture, represented by the American sample, versus an HPD culture, represented by the Chinese sample. Moreover, the conclusions of this study supported those of other studies in other parts of the world (Karia and Abu Hassan Asaari, 2019; Murphy, Gordon and Anderson, 2004; Robbins, 2001). This suggests the possible applicability of such a study when researching the influence of the concept of LPD versus HPD cultures.

Further research was conducted by the University of Southern California in the wake of Asiana flight 214 regarding the factors that contributed to this accident, which supported the strong influence of culture on the flight crew. The delay in initiating a Go-Around was found to be linked to the HPD culture of South Korea. The research also suggests that a correlation exists between the accident rate and the cultural factors of individualism and power-distance PD, as was visible in other accidents, such as the Avianca 052; where the crew did not declare a fuel emergency. Instead they requested priority to avoid delays due to cultural reasons, causing the airplane to go down due to fuel starvation resulting in many fatalities both among passengers and on the ground. A further instance occurred with Korean Air flight 801, where the captain decided to continue an instrument approach that was not reliable in a heavy rainstorm in Guam, USA. Despite the requests of the flight engineer and the first officer to go-around the captain was very late to initiate the missed approach where the aircraft hit a fuel line, and went down. Culture was again found to be a player in the sequence of events (Chow, Yortsos and Meshkati, 2014; Gladwell, 2008).

2.3 Pilot Error

Many authors explain how 80-90 percent of major accidents have been blamed on human error, but the true nature of those accidents was not truly investigated (Hasan, Chatwin and Sayed, 2019; Cohen et al., 2018; Reason, 2005, 1997). Reason (2005) added that no other reason could be cited since there is so much human involvement in such complex, high-risk industries that the use of the term “human error” could imply that all unsafe acts may be grouped under one category, which is not the case. Errors can take many different forms, can have many psychological roots, may occur at different points within the system, and may be induced by different management styles (Cohen et al., 2018; Reason, 2005, 1997).

Reason (1997) argues that the general impression of human error fails to understand that the behaviour of the people involved in high-risk industries is strictly governed by many managerial and regulatory constraints. Those constraints are categorised into two main groups; external and internal controls, where external controls include the regulatory and managerial requirements of tasks and specific ways of conducting them, while the internal controls include the knowledge and experience obtained from one’s training and personal experience. It is also argued by Reason (2016) and Cohen et al., (2018) that investigators within the medical field treat human error in a very limited way, so they miss the golden opportunity to isolate and mitigate those errors, unlike the aviation industry (Rich, Shappell and Wiegmann, 2000). Reason also supports Rich’s conclusions with different case studies from the medical field (Reason, 2016, 2005, 1997).

On the other hand, Reason et al. (1990) proposed a model of distinction between slips, lapses, mistakes and violations (Kirwan, 1994, p.87):

Slips and lapses (e.g. pressing the wrong push-button, or forgetting a step in a long procedure), are ‘unintentional’ or ‘inadvertent’ errors, mistakes are errors of intention (e.g. a misdiagnosis), and violations, contain a risk-taking element (e.g. taking an ‘illegal’ short-cut during a procedure).

Reason (2017), and Hughes and Kornowa-Weichel (2004) also elaborated on Reason's model of distinction between slips, lapses, mistakes and violations. Slips were defined as "failures during the actual execution of actions, speech, etc. (i.e. 'actions-not-as-planned') the plan itself may or may not be acceptable" (p.129). Lapses are failures within the recollection phase or "forgetting" procedures. Mistakes are errors in the selection of intentions or the method to accomplish the intended outcome, so the intended actions may proceed as planned, but fail to achieve their intended outcome. Mistakes are more challenging to identify and mitigate. Violations, on the other hand, occur when actions are performed deliberately contracting the guidelines and procedures. Moreover, violations are categorised into three different types; routine, situational, and exceptional violations. Routine violations often transpire when it becomes necessary to deviate from the usual procedures in order to save time, or in the absence of standards implementation. Situational violations are usually committed when the situation induces pressure, such as a lack of equipment or poor metrological conditions. Exceptional violations are rare and usually happen when something has gone wrong.

Another established method is the Threat and Error Management TEM by Helmreich (1999). Threat and error management includes the effective recognition and reaction to internal or external influences that have the potential to affect the safety of operations. TEM is also widely used in the medical field (Brennan et al., 2020) . Since this new method to safety has developed a distinct importance on training that encompasses further than the improvement of technical expertise in capacities such as system process and specific psychomotor skills. Fundamental to the developing emphasis on threat and error management is the point that effective operating performance is reliant on the incorporated practice of explicit technical abilities and basic nontechnical abilities such as cognitive and interpersonal abilities. The precise development of crews nontechnical abilities is not a new addition to aviation training. In direct reaction to the comprehension of the involvement of human factors to incidents and accidents, training programmes were established to emphasise nontechnical abilities. Crew Resource Management (CRM) is known as the

crews' effective utilisation of all accessible resources to accomplish safe and effective flight operations. CRM has traditionally been utilised to a significantly decrease human error and improvement of safety. The principal emphasis of CRM was the improvement of distinct nontechnical abilities; such as communication, management, decision making, and conflict resolution, in addition to stress and fatigue controlling (Helmreich and Musson, 1999; Neff, 2019; Wiegmann et al., 2009).

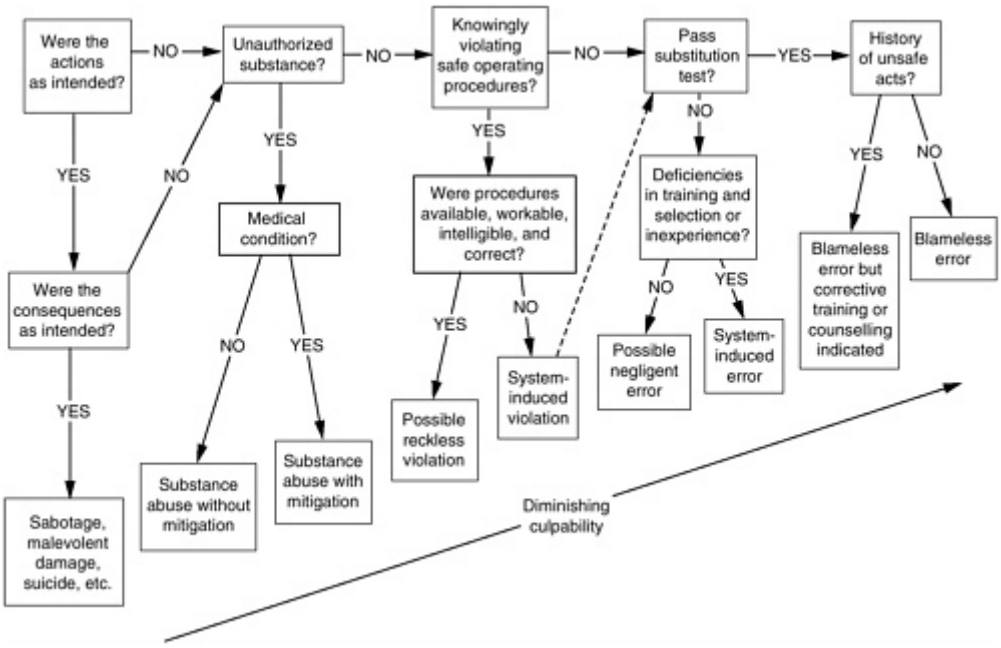

Figure 1 Culpability chart (Reason, 1997)**.**

The original culpability decision tree (as illustrated in figure 1 in a chapter titled "Engineering a Just Culture") was defined by Dr. James Reason in his 1997 book *Managing the Risks of Organizational Accidents*. The culpability chart is named by Reason as "A decision tree for determining the culpability of unsafe acts." The chart with the different questions in the boxes that form the chart is explained only in short terms by Reason; thus, reference to and usage of the culpability decision chart involves that it be done in the framework in which Reason presents it. Therefore, any operational procedure or work standard that establishes the culpability decision chart as a tool must also offer appropriate support material so that the customer can employ the tool in the means in which its author presented it (Reason, 1997).

2.3.1 Sources and Consequences of Human Error

Senders et al. (1991) comprehensively researched the human error models. The definition of human error used by Senders et al (1991) was “error is something that has been done which is not intended by the actor, nor desired by a set of rules or an external observer, or that let the task or system outside its acceptable limits” (Senders et al., 1991; p.25). Human error has been proven to be present in around 70-80 per cent of military and civil aviation accidents, at least in the 1990s (National Transportation Safety Board, 1994; Rankin, 2018; Shappell, Carolina and Detwiler, 2014; U.S. General Accounting Office, 1996) Comparing these values with more recent research on military aircraft, it was observable that they remain constant also in modern times; 65.2% of errors are due to poor personal status, and 14.5% to poor crew resource management (Lyu et al., 2018). Similarly, in the commercial aviation sector, an investigation of cognitive interaction in the 100 most fatal aviation accidents (e.g. German wings flight 4U4525) suggested a cluster of causality around individual pilot characteristics and sociotechnical cockpit performance.

2.3.2 The Perspective of Human Error

The nature and causation of human error have been the subject of study in the past e.g. with Hollnagel, (1998) and Rich, Shappell and Wiegmann (2000), demonstrating that there are several independent frameworks. Later, Wiegmann and Shappell (2001b) summarised and clustered these approaches into five different perspectives of human error in the aviation sector: (1) cognitive, (2) ergonomics and systems design, (3) aeromedical, (4) psychosocial, and (5) organisational:

1) The Cognitive Perspective; This model is based on information processing theory: i.e. information flows through a series of mental operations from a stimulus input, to response execution (Donnelly, 2019; Nidos et al., 2018; Rajaram, 2011; Wickens and Flach, 1988). In this sense, the failure of these operations generates inadequate information processing and consequently errors. Using a six-step sequence based on Rasmussen’s (1982) taxonomy of information processing failure, several studies (O’hare et al., 1994;

Wiegmann and Shappell, 1997) have sought to determine error cause. However, this model exhibits several limitations associated with the speculation of the investigators, such as the failure to address contextual factors and the lack of consideration of organisational factors in performance (Wiegmann and Shappell, 2001b).

2) Ergonomics and system design of this type of model considers the complexity and multiple causalities of accidents (Read et al., 2020): “System models recognise the inseparable tie between individuals, their tools and machines, and their general work environment” (Heinrich et al., 1980) . The most common approach is the Software, Hardware, Environment, Liveware (SHEL) model, invented by Adams (1976) and modified into blocks by Hawkins and Orlady, (1993). The approach was well received and in 1993, by the International Civil Aviation Organization. Similarly, the US Air force and Airline Pilots Association used portions of the SHEL model in their accident investigation framework. The major limitation of this model is that it is poorly suited for analysing the human component of the system (Čokorilo, 2020; Wiegmann and Shappell, 2001b).

3) In the aeromedical approach “errors are often caused by the physiological condition of the aircrew such as hypoxia, dehydration, fatigue, or spatial disorientation” (Wiegmann and Shappell, 2001b). This approach emphasises the importance of physiological factors, such as illness and fatigue (National Transportation Safety Board, 1994; Reinhart, 1996). However, other theorists perceive these factors as irrelevant to aviation safety.

4) The psychosocial perspective is the model that emphasises the relationships between pilots, their colleagues and the air traffic controllers, and its influence on pilot performance (Helmreich and Foushee, 1993). These interactions, in turn, are influenced not only by the operating environment but also by the personalities and attitudes of the individuals within each group. The major theme of the psychosocial models, therefore, is that errors and accidents occur when there is a breakdown in the group dynamics and interpersonal communications. This type of cause of accidents affects both commercial and

military aviation (Pandey and Shukla, 2019; Wiegmann and Shappell, 2000; Yacavone, 1993) and its limitation is a lack of empirical and theoretical grounds (Wiegmann and Shappell, 2001b).

5) The organisational approach is a type of model that focuses on underpinning the relationship between the organisational leadership and the cause of the human error. Some models suggest a sequence of accident causation theory, such as domino theory (Bird, 1974), Swiss-cheese model (Adams, 1976; Reason et al., 1990; Weaver, 1971). According to Wiegmann and Shappell (2001b), the major drawback is the difficulty of linking organisational errors to the time when the accident occurs.

2.3.3 High vs. Low Power-Distance Societies

Yoo and Donthu (2005) described power-distance to the general human variation in different extents, such as wealth, reputation, societal rank, and specific class. Societies with high power-distance accept that less dominant people should “expect and accept that power is distributed unequally” (Hofstede 2001, p.98). Moreover, societies with high power-distance show more dependence on the centralism and formalisation of power and greater leniency towards a lack of independence and dissimilarities between authority and capital (Minkov, 2018; Yoo and Donthu, 2005; Hofstede 2001). High power-distance societies also assign importance to prestige, wealth, and authority and are likely to agree to a command hierarchy, strong control over them, vertical top-down communications and, sometimes, discrimination based on age, sex, hometown, clan, societal class, education level or occupation. Consequently, high dictatorial and forcible power approaches achieve better outcomes for societies with high power-distance because of their acquaintance with and acceptance of variations in power levels. Societies with high power-distance are supposed to demonstrate greater lenience towards charismatic management, which is a style of authority in which a person is assumed to be the head selected by a divine power. Societies with high power-distance are fearful of powerful individuals, reluctant to disagree with them, and cautious when expressing themselves (Bochner and Hesketh, 1994). The home country has

sufficient authority to influence its residents' everyday life and principles through constitutional schemes, a common past and national pride. Some of those societies consider that their home country has a superior authority; customers in high power-distance countries are more likely to select local merchandise rather than imports because they feel grateful to follow and assist their home country. Schwartz (1994) finds that, to follow people high in a hierarchy, a person must have an intangible dominion opposite to the democratic obligation principles, such as equality, social integrity, and apprehension for others' wellbeing. Because societies with high power-distance feel larger authority gaps in uneven hierarchical relations (Spencer-Oatey, 1997), they are anticipated to show more loyal purchasing behaviour toward the home country. Purchasing national goods and opposing imports may be a way of expressing their loyalty and obedience to their home country. Consumers in high power-distance countries are thought to believe that domestic products should be dominant and privileged compared to imported goods. In contrast, consumers in low power-distance countries are unlikely to support movements opposing imports. They may consider that imports ought to be treated equally and consistently with local goods. Creating harmony between local and imported products in the market may be their goal. It is concluded that power-distance is related positively to consumer ethnocentrism, and is a measurable variable (Global Aliance of Marketing & Management Association, 2014; Pharr, 2015; Yoo and Donthu, 2005).

Lawrenson and Braithwaite (2018) elaborated how culture or organisational safety culture is strongly correlated to employee behaviour. Although cultural influence on organisational behaviour has been generally recognised, employing a regulatory standard of safety culture appears to be a significant challenge. Several regulatory programmes are emerging; they have also defined four common approaches to regulating safety culture at the international, national and organisational levels. Eurocontrol is the organisation responsible for Air Traffic Control Administration Europe; their tasks include the optimisation of the airspace over Europe to increase the capacity, which is achieved by controlling the times and flight levels of flight within the airspace

(European Union, 2019). Since 2012, it has presented a safety culture evaluation following regulation EU390/2013, where safety culture is recognised as a key performance pointer. Correspondingly, the United Kingdom's (UK) Civil Aviation Authority (CAA) and Swiss Federal Office of Civil Aviation (FOCA) have embarked on the development of a safety culture assessment programme, based on the work of Piers, Montagne and Balk (2009). In an effort to measure the essential components of safety culture and deliver a satisfactory regulatory description of safety culture for these ingenuities, six phenomenological pointers have been identified, based on the work of Piers, Montagne and Balk (2009): the management pledge to safety, safety conduct, the flow of safety correlated data, organisational compliance, employee consciousness of safety concerns and, finally, impartiality i.e. how 'just' is the organisation's culture (Lawrenson and Braithwaite, 2018).

Contradictorily, modern research by Reader et al. (2015) applied the national characteristics identified by Hofstede (2001) to manipulate safety culture pointers to facilitate national characteristics. Reader et al. (2015) and consequently Noort et al. (2016) made an important impact by identifying significant variances in national attitudes to critical aspects of safety culture and also by finding a connection between Hofstede's 'uncertainty avoidance' (UA) and 'power-distance' (PD) indices, to important safety values and principles, such as regulation implementation, risk desire, blame, flexibility and reporting trends. The research of Noort et al. (2016) delivered an additional understanding of the fundamental influence of safety culture. Nevertheless, the formation of a common, worldwide governing distinctive standard for safety culture has more major complications to resolve (Lawrenson and Braithwaite, 2018).

2.3.4 Safety culture

Defining safety culture to regulate aviation has proven to be a challenging task; however, avoiding such a definition is known to be more challenging to the aviation industry, since it would lead to ambiguity that promotes 'corporately palatable' definitions of safety culture that are politically suitable for accident

sequence (Dempsey, 2010; Kalteh et al., 2019; Lawrenson and Braithwaite, 2018).

Another study supporting this criticism was the analytical research addressing the findings of the civic inquiry into the extraordinary death rates among Mid-Staffordshire National Health Service Foundation patients. Those failures of the foundation were roughly linked to the concept of culture; principles of ‘fear’, ‘bullying’ and ‘secrecy’ (Francis, 2013, p.16). Francis eluded attributing individual legal responsibility to the investigative board by explaining the failures under the vague definition of ‘cultural’ reasons. This indicates a proposal that the flexible terminology of safety culture might be used to offset the progressively hostile practice of criminalising individual workers regarding the outcome of an aircraft accident and instead concentrating on the safety culture of the pertinent establishment (Lawrenson and Braithwaite, 2018; Francis, 2013). Supporting the findings of Lawrenson and Braithwaite (2018), it is noted that the Transport Safety Board (TSB) of Canada is among the few aviation accident investigation entities that conduct a post-accident assessment of safety culture elements. TSB’s main objective is to identify the systematic issues shaping human performance (Morley and Schwarz, 2014).

High-status accidents usually draw more investigative funds and could hold considerable political importance (Hollnagel, 2018; Hopkins, 2006; Lawrenson and Braithwaite, 2018). Therefore, such investigations frequently explore the organisational contributions behind the probable causes.

Lawrenson and Braithwaite (2018) identified several attributes of safety culture as a contributing factor, based on the study of accident investigation reports that were followed by criminal prosecution. Those reports made particular reference to corporate operations, and organisational and safety culture.

In light of the above-mentioned safety attributes of safety culture, more thorough research was applied on examples of aviation cases mentioned by Michaelides-Mateou and Mateou (2016), followed by broader research on cases recognised in several studies, after the year 2009 (Dekker, 2011; Lawrenson and Braithwaite, 2018; Trögeler, 2010). The purpose of the research is to

recognise cases where aircraft accidents involved corporate liability and the role that safety culture played in attributing this liability. The results of the research are illustrated in the research by Lawrenson and Braithwaite (2018).

According to Michaelides-Mateou and Mateou (2016), on average, there were approximately three criminal prosecution cases per year between the years 2000 to 2010 in which aviation professionals were accused of criminal offenses for committing errors that had no intention of any wrong doing. However, there is no official source that keeps track of such occurrences.

The danger is that punitive safety culture negatively influences accident investigation in two major areas; the first being the strict control of the accident site that puts constraints on investigators collecting evidence, especially perishable items. The second is the open safety reporting system; any negative influence here jeopardises the effectiveness of the safety management systems, which is formalised by ICAO under annex 19 of the Chicago convention. Having an open safety reporting system is beneficial because it helps in the detection and mitigation of safety critical matters, thus, avoiding incidents and accidents before they happen, i.e. a proactive approach. Endangering or restricting the open flow of crucial safety information would negatively affect the open safety culture, therefore, would have a direct impact on safety; as described by (Winter et al., 2020; Lawrenson and Braithwaite, 2018; Michaelides-Mateou and Mateou, 2016; Trögeler, 2010).

2.3.5 History of Accident Investigation

Shortly after the end of World War I, formal aviation began, following the Wright Brothers' first successful flight of a heavier-than-air airplane in Kitty Hawk, North Carolina. The history of manned flight was endangered after the first accident occurred in Fort Myer, Virginia, in 1908. This accident was highly significant since it was the first fatal accident from a powered flight, and marked the beginning of aviation accident investigation (Rosenberg, 2015).

In the UK, the Secretary of State was empowered by the Air Navigation Act of 1920 to regulate civil aviation, and later the conduction of accident

investigations in 1922. The Air Accident Investigation Branch (AAIB) was formerly connected to and engaged with different government departments; however, it evolved into a separate independent entity, responsible for conducting accident investigations (Michaelides-Mateou and Mateou, 2016).

Michaelides-Mateou and Mateou (2016) and Winter et al., (2020) identified the different motives for undertaking an accident investigation. The first motive is to tell the story (i.e the sequence of events); the second is to pinpoint the root causes and contributing elements that led to the occurrence; the third is to devise preventative methods to avoid similar accidents happening again; the fourth is to identify the responsible parties and prosecute them; and the final one is to evaluate liability, whereby the responsible parties must compensate for any damage (Michaelides-Mateou and Mateou, 2016, p.31).

The above mentioned motives were also mandated by Regulation EC/996/2010 of the European Council on October 20, 2010. The regulation outlines the responsibilities of the accident investigation and the subsequent prosecution process. It gives the safety investigation full authority and control over the accident wreckage and evidence, provided that this does not interfere with the member state's local regulations related to conducting the judicial investigation (The European Parliament and Council, 2010). Unlike the U.S. system, in which the adoption of safety recommendations is optional at the Federal Aviation Administration's FAA discretion (NTSB, 2015), EC/996/2010 mandates the implementation of safety recommendations by EASA, the local civil aviation authorities, manufacturers, and any concerned parties (The European Parliament and Council, 2010).

The main difference between the FAA's Airworthiness Directive AD and the EASA's AD is that the FAA acts as both State of Registry (SoR) and State of Design (SoD), where in Europe the obligation is divided between EASA (SoD) and the MS NAAs (SoR). EASA does not evaluate and accept operator's AMP documents, which is a SoR obligation, as it is also the situation outside Europe. Even though regulation EC 2042/2003 (Part M) obliges the operator's AMP to prove compliance with ICA (e.g. ALS), this ruling does not identify exactly when

compliance with the newest revision (e.g. of the ALS) must be established. Cases were reported when NAAs mandated an operator to modernize their AMP with immediate effect, leading to (needless) AOG. The EASA ALS AD consequently specifies a definite compliance time of 12 months. (EASA, 2014; FAA, 2014).

By signing ICAO (2001) under annex 13, member states are obliged to conduct accident investigations to improve safety. In Europe, the member states showed their mutual cooperation through the establishment of council directives such as EEC/1266/80, which outlined the assistance in the conducting of accident investigations. However, on November 21, 1994, this directive was replaced by EC/56/94, that outlined the essential principles of ICAO's annex 13, and was later supported by the incident reporting directive EC/42/2003 (Arnaldo Valdés and Gómez Comendador, 2011). Some of the reasons for the implementation of the new European regulation EC/996/2010, which addressed the important roles and responsibilities of the different entities, are shown in table 1, adopted from (Arnaldo Valdés and Gómez Comendador, 2011).

Table 1: Existing issues and anticipated resolutions, adopted from (Arnaldo Valdés and Gómez Comendador, 2011)

Existing issues	**Anticipated resolutions**
The need for a uniform authority given to investigators.	More authority is given to safety investigators of the EU.
Complications arising between judicial and safety investigations.	Harmonise the roles of the authorities involved in the investigation (i.e. the UK's MOU between CPS and AIBs). However, the Coroner's court is not directly involved.
No clear responsibilities of the aviation society regarding safety investigations.	Explanation of the aviation community in safety investigations.
Safety recommendations not followed-up properly.	Proper follow-up of safety recommendations.
Lack of clear protection of victims' rights.	Clarifications of victims' rights.

Another important outcome of regulation EC/996/2010 is the establishment of the “network”; the European Network of Civil Aviation Safety Investigation Authorities (ENCASIA). The establishment of the network was intended to improve overall aviation safety without jeopardising the independence of each investigation authority, and without the additional cost and burden associated with establishing a united European investigative body (Arnaldo Valdés and Gómez Comendador, 2011). It is important, here, to credit Spain’s strong leadership in the preparation and passage of this new regulation following their unfortunate experience of the Spanair accident in Madrid in 2008 and their presidency of the European Council between January and June 2010 (European Union, 2015; Ferrante, 2015; Arnaldo Valdés and Gómez Comendador, 2011; CIAIAC, 2011).

Arnaldo Valdés and Gómez Comendador (2011, p.793) argued that the fact that ENCASIA is mandated to report to the European Commission might impair some of the value of its annual report; therefore, their suggestion about reporting directly to the European Parliament and Council may be a better choice. However, this does not undermine the known benefits of establishing ENCASIA which include:

1- Enhancing the application and administration of regulations pertaining to civil aviation accident investigation, as well as facilitating the standardisation of the system.
2- Reinforcing the preventive measures of accident investigations through improving the dissemination of information between the European Commission, EASA, and the safety investigation authorities.
3- The overall improvement in collaboration when conducting accident and incident investigations.

The European Parliament and Council have also mandated regulation EU/376/2014, effective from November 15, 2015 (The European Parliament and Council, 2014). This regulation amends EC/996/2010 and replaces EC/42/2003 on the reporting of incidents and occurrences, and includes the following

requirements for organisations, adopted from the UK Civil Aviation Authority (CAA, 2015):

1- Ensuring the existence of a Just Culture.
2- Internal reporting system.
3- Database in which relevant information is stored.
4- Occurrences must be reported to the Aviation Authority within 72 hours.
5- Preliminary report within 30 days.
6- Final report within three months.

2.4 Laws

2.4.1 Civil Law Countries

In civil law countries, judicial investigations have more control over safety investigations because of the criminal law system. Taking France as an example, judicial investigations normally take the lead in any accident involving the death of a French citizen. The law in France enables the local judicial authority to acquire and safeguard the accident site; including evidence such as the accident wreckage, Digital Flight Data Recorder (DFDR) and Cockpit Voice Recorder (CVR). The French investigation Bureau (BEA), which is the safety investigation authority, can make a copy of the DFDR and CVR. However, with the implementation of the new European Council Regulation EC/996/2010, the French BEA is given the right to inspect the accident site, DFDR and CVR, and any other evidence to conduct the safety investigation (Dekker, van den Brink and Meijer, 2020; Michaelides-Mateou and Mateou, 2016; The European Parliament and Council, 2010).

Civil law is unique regarding how its trial proceedings are conducted. An inquisitorial approach is used, where the state is responsible for conducting the trial proceedings and the main objective is to discover the truth. The judge is the investigator, who will evaluate the facts and findings and issue a sentence. The independent judge works with the prosecutor, where evidence is given under oath, usually in a confidential setting, and the defendant is allowed to access

such evidence but not to draw conclusions. The judge plays the role of investigator, and the purpose of the trial is to confirm the alleged accusation. However, accident victims usually seek help through a judicial or criminal investigation because the cost of such an inquiry is covered by the state; therefore, victims and their relatives try to pressure judges into continuing the criminal inquiry even though the criminal intent is not present (Dekker, van den Brink and Meijer, 2020; Ferrante, 2015).

It is common for criminal inquiries to continue in the wake of aviation accidents, fuelled by public demand that is normally incited by the media and other public-driven sources.

2.4.2 Common Law Countries

Judicial systems based on common law, such as the UK (with the exception of Scotland) and the USA, have different accident investigation practices. Unlike civil law countries, in the UK, two separate investigations are held independently but in parallel, as per the 2008 Memorandum of Understanding between the Crown Prosecution Service (CPS) and the Air Accident, Marine Accident, and Rail Accident Investigation Branches. The main objective of the 2008 memorandum is to allow the smooth flow of the two parallel investigations (Crown Prosecution Service, 2007; Michaelides-Mateou and Mateou, 2016). In the UK (with the exception of Scotland), the CPS conducts its investigation and tests for the availability of sufficient evidence to prosecute individuals and/or corporations. The Air Accident Investigation Branch (AAIB), however, conducts its investigation to improve safety and to prevent future accidents. In the USA, the NTSB is mandated to conduct investigations into the different modes of transportation with the possibility of delegating to the local authorities. However, if there are signs of criminal acts, the Federal Bureau of Investigation (FBI) usually takes the lead (Hulme et al., 2019; Michaelides-Mateou and Mateou, 2016).

The law in Scotland differs from that in England and Wales, and the Crown Office and Procurator Fiscal Service (COPFS) investigate accidents involving abnormal or sudden deaths within Scotland. The Lord Advocate, who is head of

the system of criminal prosecution and investigation of deaths in Scotland, appoints local representatives who can direct the police's criminal investigation. The local representative is called the Procurator Fiscal, and his/her role includes the investigation of unanticipated or suspicious deaths with the means of ordering the examination of bodies to determine the cause of death. The Procurator Fiscal presents evidence at any fatal accident inquiry; such inquiries are chaired by a Scottish Sheriff, the equivalent of a judge. Entities with interests are legally presented, with no jury. For the public interest, they are conducted in the wake of any death in custody, accident at work or at the discretion of the Lord Advocate if they see fit to do so. Accident reports have been admitted to courts and accident investigators have been called to testify before Sheriffs to explain the factors contributing to accidents. Even though the Scottish system differs from the English one, they share certain similarities, as both have two independent and parallel investigations with Memorandums of Understandings (MoUs) between the criminal investigation and the safety investigation body, represented by the UK AAIB. Such MoUs allow smoother, easier collaboration when gathering evidence and the facts surrounding accidents (Green, 2015; Mawdsley, 2016; Scottish Parliament, 2016).

Examples of aviation cases that were admitted to a court in Scotland are the Sumburgh, Peterhead, and Glasgow helicopter accidents (Hamlet, Irwin and McGregor, 2020). This trend unfortunately, is increasing, with the admittance and usage of accident reports and safety investigators in court proceedings, not only in the aviation field, but also with regard to other modes of transportation. The important point here is the legal aspect surrounding a transportation accident. As Michaelides-Mateou and Mateou (2016, p.8) and BBC (2019) explained, the legal liabilities that arise after an aviation accident or incident fall into three main categories:

1- Breach of contract, in which financial compensation will be pursued.

2- Tort, a breach of duty, given by law, causes injury or damage to property, resulting in financial compensation.

3- Crime, contravening a law, which may result in a fine and/or imprisonment.

Civil liability or negligence is defined as “the breach of a legal duty to take care, which results in damage” (Michaelides-Mateou and Mateou, 2016, p.9). This may be imposed in cases where a person’s actions and/or omissions are found to have contributed to an accident. In most aviation accidents that are admitted to court, the actions and omissions have been investigated to identify any possibility of careless conduct or deviation from the regulations. Under English common law, four elements must be present to convict such defendants of negligence:

1- The defendant owed a duty of care.

2- The damage was a predictable outcome of the act performed.

3- The defendant failed to follow the standard of care.

4- As a result of such a failure, the damage occurred.

Criminal liability, on the other hand, includes the negligence of acting recklessly and therefore endangering life. Aviation professionals can be prosecuted if they are found to have violated the regulations, as stated in ICAO’s Chicago Convention article 12 that deals with the Rules of the Air. However, such prosecution differs from one state to another, subject to the specific states’ laws. For example, the FAA prosecuted a pilot and revoked his pilot flying privileges because he operated an aircraft outside the limits by taking off while exceeding the maximum take-off weight with a Centre of Gravity (CG) outside the limits, leading to a subsequent crash after take-off that resulted in injuries to the occupants (Michaelides-Mateou and Mateou, 2016, p.21).

In Canada however, there is a model of corporate liability, which was introduced in 2004 that is primarily dependent upon the actions of the upper management. It is similar to the UK’s CMCHA, but less comprehensive; merely introducing corporate liability criminal liability & homicide into the Canadian judicial system. The model of aggregation was incorporated into the Australian criminal judicial

system; companies could be held liable by its corporate culture by the enactment of the Work, Health and Safety Act of 2011 (Lawrenson and Braithwaite, 2018).

Criminal negligence differs from civil negligence since it must fulfil two conditions. The first is proof by the prosecution beyond a reasonable doubt that the person accused committed an act which is prohibited by criminal law; and, secondly, such action must have been performed intentionally, recklessly, or negligently (Smith and Hogan, 2002). However, the definition of criminal negligence differs from one state to another, in which each state's ruling contains its defining principles. Criminal negligence can be transformed into gross negligence if it involves a total disregard for human life (Michaelides-Mateou and Mateou, 2016).

There are different general categories of criminal negligence, with definitions again differing between each state. Michaelides-Mateou and Mateou (2016) divided these into three different classes, in order of severity.

a- The first is unintentional manslaughter, where the person is aware of the danger surrounding his/her acts or omissions but fails to do anything about it.
b- The second is manslaughter, where the person ignores the risks associated with his/her actions, even though such actions may cause the death of others.
c- The third, which is known in the USA, is third-degree murder, where the defendant inadvertently causes the death of a person while committing a different offence. The concept of manslaughter has now evolved to make it possible to charge corporations with corporate manslaughter. Organisations have been brought to court attempts to apportion blame for fatalities caused by accidents in which organisational shortcomings were observed. However, to charge an organisation with corporate manslaughter, the prosecution must establish that the individuals within the organisations have been found guilty of manslaughter.

This concept is relatively new in some countries, but has existed for some time elsewhere, such as France, Portugal, Spain, Denmark, and Norway. In the UK however, the Corporate Homicide Act of 2007, which is the legislation that addresses the prosecution of corporations if a series of organisational failures is identified, outlines the criteria under which companies can be prosecuted for corporate manslaughter and/or homicide. Following the passage of such legislation, an increasing trend has been observed in the UK of cases involving such allegations, as will be addressed in detail in the following sections (Michaelides-Mateou and Mateou, 2016; Roper, 2018).

Cook and Nemath (2010) argued that the research community categorised investigations as insufficient or inadequate if the main reason were “Human Error”. They continue to suggest that such investigators may have overlooked the depth or complexity of the system, in which such errors lie within the investigation itself. The important point, however, is the use of such errors to establish organisational barriers against the consequences of those errors. Careful attention should be paid to research methods that analyse and evaluate the roots of human error. This fact is also supported by Dekker, Nyce and Myers (2013), who identified several investigations that stopped and pointed out the first human error found. Identifying the guilty party is less important than being fair in pointing out the root causes of those failures.

2.4.3 Islamic Law

Islamic law is similar in many ways to common law. However, the main source of rulings is the Holy Quran, the Muslim holy book, and Sunnah, which are the teachings of the Holy Prophet Mohammed (peace be upon him). Islamic law has been governing for the past 1441 years. It is considered fair, but some Islamic countries have slowly changed the system of law they use; French colonies primarily turned to civil (Napoleonic code) and former British colonies into English common law. All in all, Islamic teachings are similar teachings to Christian and Jewish, hence it is merely a continuation of God’s message to mankind. Penalties in the Islamic law range from the death penalty for serious crimes (e.g. Intentional murder or spreading wrongdoing i.e. selling drugs) to

financial compensations (e.g. for accidental killing), depending upon the conviction. Negligence, on the other hand, is a serious offense in Islamic law, where the Islamic judge is provided with all the evidence and then it is determined if there is jail time and/or financial responsibility for the convicted person. Negligence, in Islamic law is similar to common law, where a duty of care is owed, and is neglected, thus, the person is responsible for the damages as a result of his/her negligence. It is difficult to get a clear cause, in the wake of aviation accidents, to determine the responsible parties; especially, with unintentional errors (An-Na'im, 1987; Malekian, 2011; Saiti and Abdullah, 2016).

2.5 Definitions of criminalisation

Many different definitions have been used to define the concept of criminalisation

A- Definition 1; is a legislation that makes something illegal, legislation is the act of making or enacting laws (UK, 2019)

B- Definition 2; as Statute S.54 Coroners and Justice Act 2009 S.54 (1) A person who kills or was party to a killing may be convicted of manslaughter rather than murder where there exists:

(a) A loss of self-control,

(b) The loss of self-control had a qualifying trigger (UK, 2019) The Crime and Security Act 2010 (Domestic Violence: Pilot Schemes) Order 2011

C- Definition 3;Sections 24 to 30 of the Act (domestic violence) shall come into force to the extent provided in article 3, for a period of 12 months from 30th June 2011 ending on 29th June 2012, so that the Secretary of State may assess the effectiveness of these provisions.

D- Definition 4; *"Criminalisation is certain activities by setting out, a catalogue of specified actions or omissions that are prohibited, together with ranges of sanctions for violation. It also proved to have contravened those prohibitions. Moreover, it imposes sentences upon*

those it convicts, a sentence that is drawn from a specific range of permissible sanctions" (Simester and von Hirsch, 2011, p.4).

2.5.1 Criminalisation of Human Error

Complex systems undergo conditions that are irretrievable, such as the conditions preceding an accident. Such systems continuously change as time elapses; thus, trying to replicate the exact conditions that led up to an accident is almost impossible (Dekker, 2011; Wallace and Ross, 2006). However, trained aviation personnel are continuously prosecuted for human error involving omissions or acts that were unintentional. The severity of the sentences varies from fines and license suspension, to imprisonment (Winter et al., 2020; Braithwaite, 2011; Dekker, 2011; Flight Safety Foundation, 2006; Michaelides-Mateou and Mateou, 2016).

Kringen (2014) argues that two approaches have been taken when it comes to investigations: the no-fault approach and the blame approach. These are completely different and lead to contradictory results. The no-fault or no-blame approach enhances learning development, whereas blame only allows managers and/or law-makers to discipline or prosecute (Winter et al., 2020). Leveson (2011) strongly opposed the blame approach and identified it as a challenge to safety, arguing that the main purpose of investigations is to explain the reasons why such professional trained personnel contributed to the sequence leading up to an accident.

Witnesses usually give statements that are crucial in an accident investigation process. However, witnesses might be reluctant to give such testimonies if they lack affirmation of their protection, which in turn has a destructive influence on the safety investigation process. If criminal acts are suspected, a judicial investigation should be administered, but the use of the safety investigation report in court has been increasing in the past decade, which in turn has an impact on the quality of the investigation (Lawrenson and Braithwaite, 2018; Braithwaite, 2011; Michaelides-Mateou and Mateou, 2016; Flight Safety Foundation, 2006).

One of the main factors that are fuelling the criminalisation of professional errors is the media. It has been observed on several occasions that particular cases have been promoted as being of high interest to the general public by the media. In such instances, judges may issue a harsher sentence to satisfy the public's grudge, that might not necessarily be fair and, in some instances, could lead to injustice (Dekker, 2011; Miyazawa, 2008; Winter et al., 2020).

2.5.2 Criminalisation and Crew Performance

Klein (2012) advocates that professional workers, such as engineers, should seek to mitigate the serious consequences of errors by trying to follow the procedures strictly or acquiring more experience, both of which ignore the influence of decision-making, especially regarding the carrying out of complex tasks during complicated operations. The harmonising factors of effective decisions were identified as thorough analysis to recognise problems quickly, and the rapid discovery of errors, that may lead to overall performance improvement.

Highly trained professionals with different roles and responsibilities must work together within safety-critical domains, such as the aviation industry, to make coordinated decisions. A parallel study was conducted by Bearman et al. (2010), in which breakdowns in coordinated decision-making were evaluated using two samples. The first sample consisted of safety reports regarding communications between pilots and air traffic controllers in the US, and the second sample was communication reports from the Apollo 13 space project. It was found that the breakdowns in decision-making contained lower-level breakdowns which were divided into three main categories; operational, informative, and evaluative. It was observed that operational breakdowns were generally caused by informative and evaluative breakdowns. With some known limitations to the study, it was suggested that decision-making research should be applied to other disciplines (Pandey and Shukla, 2019).

Safety investigations as well as safety management systems have evolved over time and heralded excellent improvements to the overall conducting of aviation operations. However, both processes necessitate a deeper study of the risks

associated with decision-making, and the decision-making settings of different players (Stoop and Dekker, 2012). Therefore, previous studies suggest that a gap exists in the literature regarding the influence of the perception of criminalisation on crew performance.

2.5.3 Fear of Punishment and Culture; Punitive Safety Culture and Influences

Given the conflicting interests within the accident investigation process, there will be some room for negotiation, whether direct or indirect. However, organisations and their safety cultures are being endangered by the fear of being prosecuted for mistakes. Fear will lead to the concealment of mistakes which, in turn, jeopardises the learning opportunity presented by such organisational mistakes. Braithwaite (2011) and Lawrenson and Braithwaite (2018) advocate that investigators should find a middle ground in order to balance the pressure from different entities demanding answers, so it is essential for investigators to adopt well-defined approaches when dealing with evidence in a timely manner. Braithwaite, however, opposes the idea of fear and the loss of trust, which is highly destructive to the pillars of a successful safety culture.

Although a safety culture was originally initiated in accident investigation and despite its growing recognition by different organisations, the fact remains that it was scarcely mentioned in operational accident investigations. In the study of Strauch (2015) from the US NTSB regarding the analysis of safety culture in accident investigations and the consideration of substituting such an analysis with different approaches to evaluate the contribution of corporations in safety occurrences, it was found that such approaches may allow accident investigators clearly to interpret and address the characteristics of the organisational culture based on the outcomes of such investigations.

Strauch (2015) identified numerous reasons that challenged the direct assessment of companies' safety culture during an investigation, due to inconsistencies between the management theories and worker practices. Furthermore, the consequences of an accident have a powerful effect on

employee attitudes, among those who may have to live with the possible results of injury, death, or property damage. An accident sometimes denotes a failure of the organisational and individual efforts that have been ongoing for years. While culture is usually believed to be a steady component, surveys were found to be less steady, irrespective of the questioners' value, and vastly measured approaches (Salmon et al., 2020; Strauch, 2015).

Somewhat contradicting Strauch (2015) is the study of Morrow, Kenneth and Barnes (2014), who conducted an analysis of safety culture in the US nuclear power industry, in which the concerning cultural factors were investigated. An evaluation of the interactions between the safety culture factors was conducted, as well as other safety performance and organisational procedures. However, this research is among the initial studies to examine in detail the possible relationship linking the measured data by the industry with measurements of safety culture within nuclear power organisations. The results of the survey made it possible to investigate how organisational-level performance measures relate to perceptions of safety culture among nearly all functional nuclear power plants in the US (Morrow, Kenneth and Barnes, 2014).

Opportunities for catastrophic disasters were created by the weaknesses in the organisational safety culture. This is clearly shown in investigations that were conducted in the aftermath of tragedies such as the Chernobyl and Three-Mile-Island accidents. It is feasible, however, to provide controlling measures before such a substantial event occurs by applying safety culture evaluations that may serve as leading pointers of performance (Morrow, Kenneth and Barnes, 2014).

The correlations of the study of Morrow, Kenneth, and Barnes (2014), as measured by the conducted survey, implied the existence of critical, statistically significant connections between different nuclear power plant performance indicators, and safety culture. This study takes a critical step towards establishing the view that safety culture is empirically correlated to safety performance.

Even within a single industry in the same country, the relationship between safety culture and safety performance is highly dependent on how and when

they are both measured, as well as the limitations associated with conducting surveys (Dismukes, 2017b; Morrow, Kenneth and Barnes, 2014).

On the other hand, replicating and applying the same methods of safety culture to different industries can prove challenging. Lewis et al. (2011) conducted a study in which aviation safety aspects were applied in the medical field. The conclusions of this study showed that resistance to change existed within the culture, but this may improve over time, and these changes might become acceptable, as supported by the study of Sax et al. (2009). In this study, a slight change in culture was observed over a few years, following the application of crew resource management in the medical field. Consequently, it is possible to influence culture; hence, culture is on-going and could be influenced by different external and internal factors. Therefore, the introduction of the criminalisation concept may have an influence on the safety culture within organisations, the impact of which should be examined. Also supporting these findings was the research of Brennan et al. (2020) that applied methods similar to aviation safety in the medical field, and concluded that many errors could have been prevented by methods that are used in the aviation industry; such as Threat and Error Management TEM and other safety nets such as check lists.

2.6 Initial findings

2.6.1 Initial Framework to Formulate the Concept of Pilot Error (CoPE)

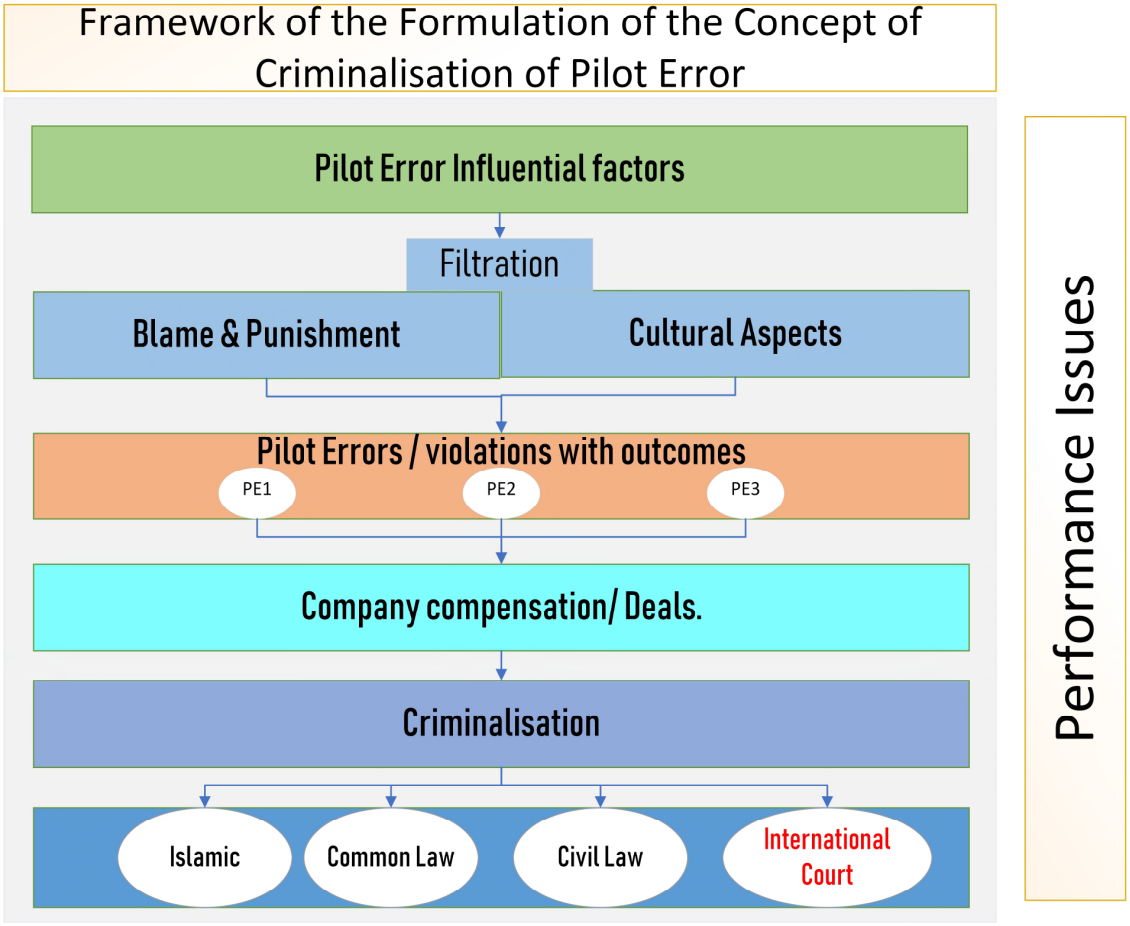

Figure 2**:** Initial Framework

2.6.1.1 Pilot Error Influential factors

Pilot error influential factors are the factors that influence pilots to make errors. Human error has been proven to be present in around 70-80 per cent of military and civil aviation accidents, and the following studies are documented examples of pilot error that have been lifted from existing literature(Rankin, 2018; Kontogiannis and Malakis, 2009; Shappell et al.,

2007; U.S. General Accounting Office, 1996; National Transportation Safety Board, 1994).

1. Errors in communication; miscommunication is one of the biggest sources (Bearman et al., 2010; Harris and Li, 2008; Wiegmann and Shappell, 2000; Yacavone, 1993).
2. Cognitive errors; i.e. forgetting procedures leading to errors (Kirwan, 1994, p.87; Noort et al., 2016).
3. Ergonomics and systems design; i.e. accidents resulting from engineering failures, where error is the product of the design (Braithwaite, 2017; Rankin, 2018; Stoop and Dekker, 2012; Tuttle, 2015).
4. Aeromedical; physiological conditions, illnesses and fatigue (Wiegmann and Shappell, 2001a, 2017).
5. Psychosocial or perceptual errors, when a pilot makes an error but cannot admit it (Wiegmann and Shappell, 2003). This also includes psychological factors; that are mental operations from stimulus input to respond to execution and errors in decision-making (Bearman et al., 2010; Cohen et al., 2018; Hawkins and Orlady, 1993; Reason, 2005; Wickens and Flach, 1988; Wiegmann and Shappell, 1997).
6. Organizational factors (Lawrenson and Braithwaite, 2018; Strauch, 2015; Morrow, Kenneth and Barnes, 2014; Braithwaite, 2011; Bird, 1974). This includes procedures, training and/or the environment, including the organizational environment (Tuttle, 2015; Dekker, 2001). This could also include violations (i.e. following the wrong procedure) since they are part of each organizational practice in procedures, violation means following the wrong procedure (Wiegmann and Shappell, 2012).
7. “intent” Failure to achieve their intended outcome; failures during the actual execution of actions (Hughes and Kornowa-Weichel, 2004; Kirwan, 1994, p.87; Reason, 2017).
8. Poor personal status, which includes the mental status of pilots (Lyu, Xiao and Zhou, 2018).

9. Characteristics and sociotechnical cockpit performance; this is in part genetic, and partly learned through experience and education (Lyu, Xiao and Zhou, 2018).
10. No knowledge or experience obtained from training and one's personal experience (Cohen et al., 2018).
11. Lack of addressing contextual factors and not considering organizational factors in performance (Cohen et al., 2018).
12. Accidents occur when there is a breakdown in the group dynamics and interpersonal communications between the aircraft crew (Wiegmann and Shappell, 2000; Yacavone, 1993).

2.6.1.2 Blame and punishment; Cultural Aspects

The first filtration layer of the CoPE framework is blame and punishment; cultural aspects. This layer is important for many reasons, those important reasons areas explained below:

A- This filtration layer is essential to mitigate the outcomes of pilot error; for example, companies often mandate pilots to undergo training in the wake of incidents and/or Flight Data Monitoring (FDM) events. However, depending upon their respective culture, pilots may perceive this as an act of punishment rather than a supportive action by the airlines. Based on the researcher's observation of the aviation industry, in HPD cultures (especially in Far-Eastern and Middle-Eastern countries), pilots usually perceive extra training as a punishment. This carries with it a high risk of affecting the safety culture. In LPD cultures, however, pilots usually consider this as a supportive action by the company (Dismukes, 2017a; Winter et al., 2020).
B- On the contrary, HPD cultures contain some traits that would prevent the outcomes of pilot error from expanding. For instance, when a co-pilot "first officer" flies with a senior captain, in HPD cultures, errors are usually found and mitigated silently, hence pointing out an error is considered disrespectful in such cultures. The opposite is normally true in LPD cultures, where errors are normally found and pointed out, then corrected or mitigated in a more relaxed

environment. This poses a cultural difference that should be considered by the aviation community (Reason, 2017).

C- As referred to in the literature identified in review section 2.3.3, many studies show a clear relationship between aircraft accident rates and national culture (Tear et al., 2020; Al-Wardi, 2017; Li, Harris and Chen, 2007; Helmreich and Merritt, 2001; Jing, Lu and Peng, 2001). These studies concluded that national culture could have an impact on accident rates. However, caution is advised because the HFCAS, invented in the USA, may include a type of cultural bias.

D- The topic has been vigorously considered by academia; some authors argued that there is a strong relationship between HPD cultures and accident rates. More recent studies such as Michaelides-Mateou and Mateou (2016), Soeters and Boer (2009), and Harris and Li (2008) have proved that aircraft accidents in Africa and Asia (HPD regions), have five times more aircraft accidents than America and Europe (LDP regions). Furthermore, the study demonstrated that in Africa and Asia one recurrent factor in the accident rates were failures regarding poor Crew Resource Management (CRM), which are 30 to 40-fold higher than the likelihood of errors in decision-making, perceptual errors, and violations in procedures (Wiegmann and Shappell, 2003). The reason behind this increment could be that HDP nations consider questioning superiors as disrespectful, because the relationship between managers and workers is formal and, sometimes, communication is restricted (Harris and Li, 2008).

E- Accident rates differ across the globe, with Asia and Africa generally having higher ones than Europe and North America (Tear et al., 2020; Arnaldo Valdés and Gómez Comendador, 2011; Harris and Li, 2008). Such a difference is usually attributed to a failure within Crew Resource Management (CRM). Those continents have HPD cultures, a dimension that defines the power-distributed among a group of working individuals (Hofstede, 2001), in which questioning superiority is considered disrespectful, leading to power-distance.

2.6.1.3 Company deals/compensations

Companies have departments for handling customer complaints and settling cases. However, there is a certain timeframe in which the company must

respond to such complaints before they are elevated to court. This is an important filtration process, where people who are involved in such occurrences or their loved ones might respond positively when treated well.

The procedure for a complaint against an airline starts with the affected party taking the complaint directly to the airline or airport. The complaint should be in writing, specifying the time within which the airlines or airport must reply to the affected party. If the response from the airline is unforthcoming or dissatisfactory, then the affected party can refer their complaint to an alternative dispute resolution (ADR) body, CCA, or take direct legal action against the airline.

Both, the ADR bodies and PACT, will advise on whether they think the affected party has a valid complaint and, if so, will take it up with the business concerned. However, PACT cannot impose a decision on an airline while CAA approved ADR bodies can do so (CAA, 2015a, 2015b).

2.6.2 Research scope

The surveyed Chinese had fewer expectations of their managers and demonstrated a great interest in improving and changing their career than their counterparts in the US (Yi et al., 2015). This provides an example of an LPD culture versus an HPD culture. Moreover, the conclusions of this study supported older studies (Murphy, Gordon and Anderson, 2004; Robbins, 2001). This suggests the possible applicability of such a study concerning the influence of the perception of the concept of criminalisation on LPD versus HPD cultures.

Further research was conducted by the University of Southern California in the wake of Asiana flight 214 regarding the factors that contributed to this accident, which supported the strong influence of culture on the flight crew. The delay in initiating a Go-Around was found to be linked to the HPD culture of Korea. the research also suggests that a correlation exists between the accident rate and the cultural factors of individualism and Power-Distance, which was also visible in other accidents, such as the Avianca 052 and Korean 801 (Bennett, 2019; Chow, Yortsos and Meshkati, 2014; Gladwell, 2008).

1- The study of (Yi et al., 2015). This provides an example of a LPD culture versus an HPD culture. Moreover, the conclusions of this study supported older studies (Murphy, Gordon and Anderson, 2004; Robbins, 2001). This suggests the possible applicability of such a study in the research on the influence of the perception of the concept of criminalisation on LPD versus HPD cultures.

2- The research also suggests that a correlation exists between the accident rate and cultural factors of individualism and Power-Distance , which was also visible in other accidents, such as the Avianca 052 and Korean 801 (Chow, Yortsos and Meshkati, 2014; Gladwell, 2008)

3- The of study Stemn et al. (2019) takes a critical step towards establishing the view that the safety culture is empirically correlated to safety performance, which agrees with an older study of Morrow, Kenneth and Barnes (2014).

4- The studies of Brennan et al. (2020) and Lewis et al. (2011) in which aviation safety aspects were applied in the medical field. The conclusions of this study showed that there was resistance to change within the culture, but that this may improve over time and these changes might become acceptable. Supported by the study Sax et al. (2009); where a slight change in culture was observed over a few years, following the application of crew resource management in the medical field. Consequently, it is possible to influence culture; hence, culture is on-going and could be influenced by different external and internal factors. Therefore, the introduction of the criminalisation concept may have an influence on the safety culture within organisations, the impact of which should be examined.

5- The study of Al-Wardi (2017), which concluded that national culture, plays an important role in the human factors related to aviation accidents. The relationship was developed using a cross-cultural comparison conducted between three countries: Oman, Taiwan, and the USA. The data obtained from the accident investigation reports were classified using the HFACS system.

A review of the relevant literature suggests a gap in the aspects surrounding the concept of criminalisation. Thus, the aim of the research is to evaluate the effects of the criminalisation of human error, and its subsequent punishment in the aviation industry.

1. What is the judiciary law that applies to the criminalisation of pilot error in the aviation sector?

Globally, there is no unified law that applies to pilots to address the criminalisation of pilot error. For example, the outcomes of pilot error could have different consequences if they occur in various nations, with different judicial systems; in the United States, passengers have pursued compensation due to injuries caused by unexpected air turbulence, with the seat belt sign off. In other countries, affected passengers cannot do this, since it is out of the pilots' control and they cannot be held liable for it (Michaelides-Mateou and Mateou, 2016; Winter et al., 2020).

2. What are the key factors that influence pilot error during the course of their duties?

Many factors influence pilot error; however, they have neither been explained nor detailed before in the literature. Therefore, it is crucial to address such influential factors, and to develop a comprehensive list of them.

3. Is there an agreement of cultural aspects that influence pilot error in aviation?

People, by nature, are different; depending upon the region they grew up in, or the nation, to which they belong, and their culture and traditions evolve. Culture is a vast topic, which researchers break down into different categories. Based on previous research done by Hofstede, culture can be broken down into several traits. For the purposes of this research, only power-distance will be addressed. According to previous research, power-distance is important and it differs significantly by region. For example, in the United Kingdom, questioning authority is not considered disrespectful, as opposed to the situation in Far-Eastern cultures.

4. What are the key elements that cover all aspect of criminalisation of pilot error?

Some elements are mentioned in the literature; however, a comprehensive list is needed to cover all of the aspects surrounding the criminalisation of pilot error. Unfortunately, the trend of criminalisation of pilot error is increasing. Therefore, it is urgent to address such elements and investigate them thoroughly in order correctly to guide safety investigators on how to tackle such an issue.

2.6.3 Research aim

The aim of this is paper is the formulation of the concept of criminalisation of pilot error (CoPE) from the stakeholders perspective, and to develop an international systematic approach that deals with CoPE in the wake of accident investigations, using statistical methods to validate such an approach.

2.6.4 Research objectives

1. There is no judiciary law that specifically addresses the criminalisation of human error in the aviation sector.

Paragraph 2.4.1 of the law states that, in Civil Law countries, judicial investigations have more control over safety. This normally only applies to the accident involving the death of a citizen of that country. There is also a long procedure that needs to be gone through, even though aviation accident investigations are fueled by the public who are incited by the media, before the accident victims may receive the compensation to which they are entitled.

Similarly, in paragraph 2.4.2, Common Law countries still lack a specific judiciary law for human error in the aviation sector; the UK, for example, has two separate investigations, which are not clearly aimed at human error in the aviation sector. The law which countries normally apply to cases of human error in the aviation sector is a criminal judiciary system, which normally involves only the death of a person (manslaughter).

Therefore a specific jurisdiction needs to be introduced specifically for human error within the aviation sector, as this can include many factors besides simply manslaughter.

2. There is no comprehensive study that compiles all of the key factors that influence pilot error during the course of their duties.

Section 2.3.1 clearly shows that there is no specific study which identifies all of the key factors that influence pilot error during the course of their duties. However, there are general factors about human error, as shown in section 2.3.

3. There is no clear agreement on the cultural aspects that influence pilot error in the aviation sector.

Section 2.3.4 shows the culture that can be adopted in the aviation industry, such as a safety culture, which is suitable for accidents consequences. There is also the concept of culture, the principle of fear, bullying and secrecy. However it is difficult to obtain an accurate record of the number of criminal cases in the aviation sector, so it is impossible to identify which cultural aspects influence pilot error in the aviation sector.

4. There is a lack of well-defined elements that cover all aspects of the criminalisation of pilot error.

Section 2.5.1 explained the criminalisation in the aviation sector as a general approach to crew performance and did not specify a pilot aspect of criminalisation at all. Therefore, a well-defined element that covers all aspects of criminalisation aimed specifically at pilot error is required.

3 METHODOLOGY

This research will be administered through nine phases, as demonstrated in figure 2. The first phase is the literature review, which is conducted to explore the issues surrounding the concept of the criminalisation of pilot error in the aviation industry. Phase 2 entails the identification of research gaps, which introduces the research questions. Phase 3 is the development of the questionnaire based on the literature review. In order to deliver answers, a field study is most suitable; online surveys were used in phase 4, and a focus group was used phase 5. Phase 6 uses data gathered during phases 4 and 5 to develop the initial Criminalisation of Pilot Error (CoPE) framework. Phase 7 aims to evaluate the effectiveness and applicability of the CoPE framework by conducting interviews with Subject Matter Experts (SMEs) in the aviation industry. In Phase 8, hypothetical case studies were applied to validate the CoPE framework by simulating its practical applicability. Phase 9 involves the generation of the final CoPE framework.

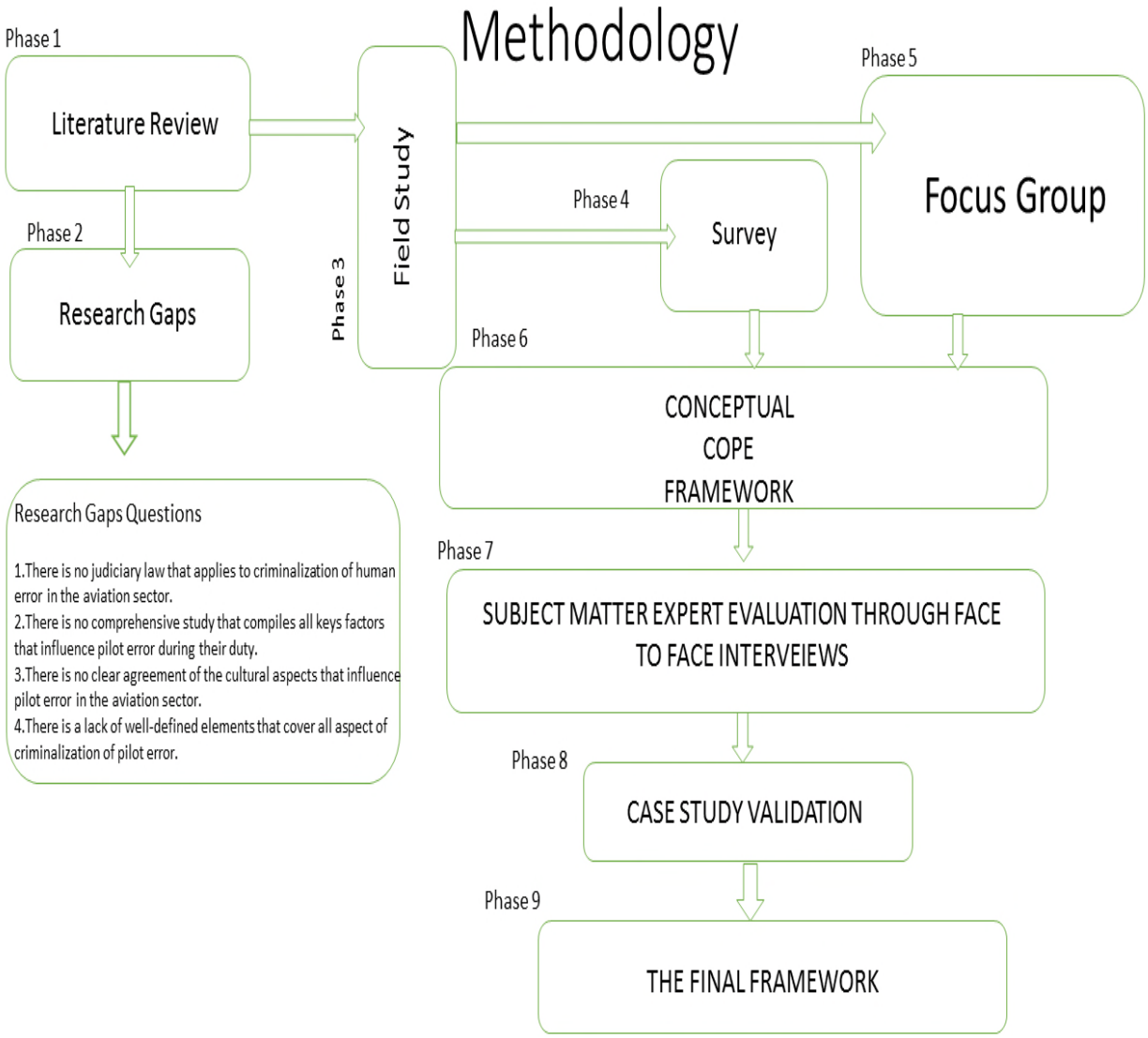

Figure 3: Methodology flowchart

3.1 Literature search and field study

The research aim will be addressed using qualitative and quantitative methods. The research will be administered through nine stages, as explained above. The phase of the literature search was conducted to identify and consolidate the research gaps. It also suggested that conducting surveys and interviews is suitable for research of a subjective nature (Kılınç and Fırat, 2017). The first part of the field study was the questionnaire survey, which was distributed to 5,000 pilots around the globe using the Cranfield University IT Department. Due

to the high number of emails only the IT department was authorised to send those emails at once. Other aviation professionals were excluded from this research due to its narrow scope, which is to evaluate the pilots' perspectives on criminalisation. The field study included the evaluation of people's perceptions of the concept of criminalisation from the aspects of awareness and crew performance, culture, and different legal systems (Creswell, 2014; Liu and Wang, 2015; Winter et al., 2020).

Despite their known limitations and issues with their validity and reliability, questionnaires were chosen for the first part of the research due to their ability collect the subjective data required by this research (Liu and Wang, 2015; Stanton et al., 2005). The responses were analysed and the main themes were identified in order to enhance the questionnaire-survey. Questionnaires are also relatively easy to disseminate and collect using programs such as Qualtrics, which make data storage and their subsequent treatment manageable. The following stage of the research will be a qualitative evaluation of the survey results, combined with semi-structured interviews with aviation experts to acquire qualitative data to evaluate the framework. After that, the CoPE framework is developed and validated by case study validation (Hicks et al., 2015; Liu and Wang, 2015).

3.2 Questionnaires

A survey was put together as a collection tool alongside, interviews, focus groups, and Subject Matter Expert reviews to deliver the data needed for this research. A questionnaire was distributed to a sample of aviation professionals (pilots) via an invitation link, for the purposes of measuring the above-mentioned aspects of the criminalisation of pilot error. The survey included close-ended and Likert scale questions that produced quantitative data. Subsequently, the quantitative data were treated using a data treatment program such as the Statistical Package for the Social Sciences (SPSS) in order to identify any possible correlations. Since the research examines people's perceptions of the criminalisation of human error, it suggests the

importance of people's opinions regarding this matter (Stanton et al., 2005; Winter et al., 2020).

3.2.1 Questionnaire design

The main objective in designing the questionnaire is to serve the research objective (Greenfield, 1996; Yin, 2009). The design should also incorporate accessibility factors such as the language in which the questionnaire is written, and the interface through which the participant can provide more accurate information. It is argued within the research community that anonymity is favourable, especially for a topic that addresses human error and being open about admitting errors. It has been argued that questionnaire surveys are not the best tool for constructing rigid research and drawing conclusions (Robson, 2002; Yin, 2009). However, for the purpose of this specific topic, these were determined to be the best choice since they allow easier access to the research sample. Moreover, a similar questionnaire survey was conducted by Winter et al. (2020) at Embry-Riddle Aeronautical University with the support of Aircraft Owner's and Pilot's Association (AOPA), and Air Safety Institute (ASI) all of which are prestigious aviation organisations in the USA; and the research produced valuable outcomes. Additionally, the research of Merritt (1997) at the University of Texas, which was funded by NASA and the FAA and was found to produce significant results.

3.2.2 Pilot study

A group of participants was asked to complete the survey and comment on it. Their responses were as follows:

1- Participant 1, Senior Boeing 777 Captain with the prestigious Middle East-Based Airlines, commented on the wording of certain questions, and the need to simplify the questions and answers to obtain quality data.

2- Participant 2, Safety Manager of the prestigious Middle East-Based Airlines, completed the survey in October 2016 and commented on its length, combining similar questions and the elimination of certain questions as well.

3- Participant 3, Manager of Standards and Performance Air Investigation Branch at a prestigious North American investigative body provided several valuable comments in October 2016, some of which were related to the wording of certain questions. He offered the excellent idea of adding maps of the different regions of the world to allow the participants to choose the locations for their operational base, which significantly enhanced the participants' experience.

4- Participant 4, Lecturer at Cranfield University, added some valuable comments on the introduction of the survey and the privacy consent that helped with acquiring ethical approval from CARES.

5- Participant 5, from a prestigious European investigative body commented on the questions as follows:

"The answers to the first question are too airline-oriented. It seemed to me that the survey was for any aviation professional but there are mainly choices linked to carriers...

As a general view, I think that the questions of the survey give the impression that errors and deviation from Standard Operating Procedures (SOP) lead systematically to prosecution or accidents. The approach of the survey is therefore too much based on conformity, compliance, quality and not at all linked to safety or reliability. With a Human Factor approach, most of the questions are very strong and "binary".

Otherwise, I think it will be interesting to analyse the result of this survey that will certainly make it possible to discuss cultural differences."

The author acknowledges that this research is aimed at an international audience with varying degrees of English proficiency. Therefore, taking these comments into consideration, the language used in the questionnaire was intended to be easy-to-understand English. This is because pilots are required to acquire and maintain at least a level four English proficiency level as it is the approved international language of the aviation sector (ICAO, 2017).

3.3 Cultural Aspects

The qualitative method will be used to gather and process the initial data. Sharma (2010) conducted three studies and reviewed some of Hofstede's cultural dimensions, such as Power-Distance (PD). Sharma reformed Hofstede's PD theory into "Power" and "Social Inequality", which he describes as positively correlated. Power is defined as the extent to which differences in power are accepted by individuals, or how people relate to authority. On the other hand, social Inequality is defined as the degree of inequality that is accepted as normal and it concerns hierarchy verses equality (Hu et al., 2018; Sharma, 2010; Taras, Rowney and Steel, 2009).

PD was initially defined as the "extent to which the less powerful members of a society expect and accept that power is distributed unequally" (Hofstede, 2001, p.98). Societies with HPD give importance to wealth, and power; such cultures may also admit discrimination against religion, age, and social class (Oruh and Dibia, 2020; Sharma, 2010; Yoo and Donthu, 2005). Therefore, the members of such cultures usually care about their reputation and are under social stress regarding the loss of such status (Hu et al., 2018).

Sharma chose four countries in which to conduct his study: the UK, the USA, India, and China, as they have substantial differences regarding their national cultural dimensions (Minkov, 2018; Hofstede, 2001). The UK and USA are generally high in individualism and masculinity, but generally lower in other cultural dimensions. China, however, represents low individualism, masculinity, and uncertainty avoidance, and is an HPD culture. India, on the other hand, is also an HPD culture, but moderate in the other cultural dimensions (Sharma, 2010). This study extends the previous research on cultural orientation by introducing the concept of power and social inequality as a positively correlated dimension. Sharma suggests that future research should include more descriptive samples taken from a wider selection of nations and backgrounds, using a different methodology to generalise and confirm his proposed cultural orientations (Hu et al., 2018; Sharma, 2010).

Other research used a random sample of Chinese and German business owners to identify and compare seven cultural values: PD, in-group collectivism, future orientation, humane orientation, performance orientation, uncertainty avoidance, and assertiveness. The PD and humane orientation measurements were higher in the Chinese sample. The German sample, however, scored higher on assertiveness. The research was conducted using surveys consisting of scenarios chosen to measure specific cultural orientations; this study took the form of a pilot study conducted with business college students (Hu et al., 2018; König et al., 2007; Sharma, 2010).

The study suggests that such scales hold cross-cultural validity, enabling scholars to compare the means and conduct cross-cultural comparisons of the relationships involving PD, in-group collectivism, future orientation, humane orientation, and performance orientation. However, the relationship between uncertainty avoidance and assertiveness should be treated with care. With some known limitations to this study, using the same methods in other culture-related disciplines appears valid, such as measuring the effects of criminalisation on LPD versus HPD cultures (Hu et al., 2018; König et al., 2007).

In the Far East, another study was conducted in South Korea to evaluate the perception of Corporate Social Responsibility (CSR) among public relations practitioners based on Hofstede's cultural values. The study suggests that the Korean public relations practitioners revealed relatively high values for femininity, masculinity, and collectivism, but low individualism and PD (Kim and Kim, 2010). The study used a questionnaire in order to survey and measure Hofstede's cultural values. Korea and China along with some Far Eastern countries are known for their HPD cultures; this can be observed in the way they respect their elderly people, and the respect for hierarchy, as well as their reservations on expressing opinions and opposing views with bosses and senior employees. In a sense, the study of Kim and Kim (2010) was replicating Hofstede's study in a different field, which suggests the applicability of surveying and measuring Hofstede's values in different fields (Minkov, 2018; Hu et al., 2018; Kim and Kim, 2010).

3.4 Validation of the CoPE framework

Two methods will be used to validate the CoPE framework. The first method is subject matter expert (SME) judgement through face to face interviews. This is followed by a case study validation, where samples of previous accident/incident reports involving pilot error will be employed to validate the CoPE framework.

3.5 Collection tools

3.5.1 Questionnaire

The developed questionnaire was distributed to approximately 5000 aviation professionals through Cranfield's Information Technology Department. However, the return rate was less than anticipated, with only 186 responses, 86 of which were usable. As explained in the methodology section, this research will be conducted using the mixed (quantitative and qualitative) methods.

3.5.2 Questionnaire responses

The questionnaire survey, that collected 107 responses, was launched in 2016 in the middle of a series of cyber-attacks, which is the main reason for the very low response rate. The questionnaire contained open ended questions to aid in delivering the research objective. According to Cohen and Crabtree (2006), it is advisable to use semi-structured interviews, which in this case are replaced by open ended questions, because they offer an excellent opportunity to gather qualitative data. This technique has been used in many research disciplines; the recent study of Simons et al. (2018) involved semi-structured interviews containing open ended questions as a dependable method for their data collection. For the purposes of this research, response coding was used to analyse and process the qualitative data collected using open ended questions. Both inductive and deductive approaches were applied in analysing the qualitative data about the two main questions with six subheadings, followed by the identification of the themes and sub themes (Bryman, 2016; De Noronha, Coca-Stefaniak and Morrison, 2017; Simons et al., 2018).

3.5.3 Focus group

The focus group method has become popular recently. According to Katz (2001) in this practice, a small set of people with mutual features or interests is gathered by a mediator to observe the group dynamics. It is conducted to achieve understanding concerning a specific subject; this method is occasionally chosen because it saves time compared to interviews (Guest et al., 2017; Morgan, 1997; Sarantakos, 2012).

Many researchers have labelled them as a ‘fast food’ form of qualitative research with the foremost benefit of producing data through the open use of group collaboration (Guest et al., 2017; Sarantakos, 2012). Additionally, focus groups are believed to aid in examining individual answers that are impacted by the other group members.

The information gathered from focus groups may offer a better understanding than those gathered from a collection of separate interviews (Guest et al., 2017; Morgan, 1997), since the members may feel the necessity to question each other and offer more explicit responses that accelerate the regular social methods through which the participants assess each other’s views. This, in turn, leads to the generation of additional data that is significant to the research study (Sarantakos, 2012).

An additional advantage of assembling focus groups is that they allow scholars to test the questions associated to the reaction of the group (Guest et al., 2017). Moreover, Morgan (1997), established that focus groups reduced the burden on the candidates to express themselves and decreased the researcher’s tendency to interrupt the stream of thought during an interview.

A focus group was found to be a reliable collection tool, given the subjective nature of this research. Some advantages of focus groups are:

1- The results are more realistic or natural than those obtained from interviews.

2- An extensive variety of perceptions can be produced.

3- The topics are deliberately discussed, debated and justified; new topics can be recognised.

A homogenous focus group consisting of four pilots was conducted to identify the influential factors regarding pilot error, a list of pilot errors in their opinion, and violations from both the pilot and the company side. The focus group showed agreement with some of the influential factors from the literature, and also disagreements with certain factors. This will be discussed later, in the results and discussion section (Guest et al., 2017; Sarantakos, 2012).

The homogenous focus group consisted of four pilots who have flown in more than ten countries around the world. The combined experience of the focus group was over 35 years, which is sufficient to consider their opinions and inputs on the related subject, and was found suitable to represent the opinion of the industry. The focus group contained members who had lost a relative in an aviation accident; others had family members and/or loved ones who were involved in company/government aviation investigations. The group members were educated, with degrees in aviation safety management, business administration, and law.

They were provided with the consent form in accordance with the university's ethical approval policy, which specifies that the information collected will only be used for research purposes. The group agreed that the session could be recorded for reference, to be transcribed later for qualitative analysis.

3.5.4 Interviews with Subject Matter Experts SMEs

The interviews were conducted with subject matter experts to obtain their input on the CoPE framework and the interview candidates were chosen from different parts of the world. For the purposes of this research, SMEs were considered to be pilots with more than 20 years of experience who were involved in aviation accidents and/or incident investigations.

According to Cohen and Crabtree (2006), it is advisable to use semi-structured interviews when the chance of meeting the interviewee is limited and when

there is a field study to conduct. Face to face interviews may provide comparable and reliable qualitative data. As used in many research disciplines, Simons et al. (2018) recently employed semi-structured interviews as a reliable method of data collection in their family/social study. Interviews with open-ended questions to survey related areas surrounding a specific topic are useful in identifying new ways to identify fresh perspectives to understand the related subject. However, it was more suitable for the nature of this research to use semi-structured interviews including a few open-ended questions. The list of questions was developed from the literature review, the questionnaire results, and the focus group results. This method is called the deductive method, where the literature was reviewed to derive the different elements of the framework along with the results of the focus group and questionnaire survey. Also, Bryan (2016) used the deductive approach, from the general to the specific, a method that is used widely in social science research (De Noronha, Coca-Stefaniak and Morrison, 2017).

3.5.5 Case study validation

The CoPE framework will be validated using case study validation of aviation occurrences, where each element of the framework is explained in detail to validate the applicability of the framework (Balls, Worth and Combes, 2019).

3.5.6 Sample definition

The research sample consists of pilots from different parts of the world. Pilots were chosen since this research focuses on pilot error and the subsequent criminalisation of these errors' consequences. Another issue is the language, since pilots are tested to possess ICAO level four in English language. They were found to be suitable to invite to fill out those surveys and to participate in the focus group and the interviews; the nature of this research does not offer translations into other languages, since many data are lost during translation (Winter et al., 2020).

3.5.7 Survey distribution

The developed questionnaire was distributed to approximately 5000 aviation professionals through Cranfield's Information Technology Department. However, the return rate was less than anticipated, with only 186 responses, 86 of which were usable, mainly due to cyber-attacks in the year of the survey distribution. As explained in the methodology section, this research will be conducted using the mixed method: quantitative and qualitative methods.

3.5.8 The initial framework

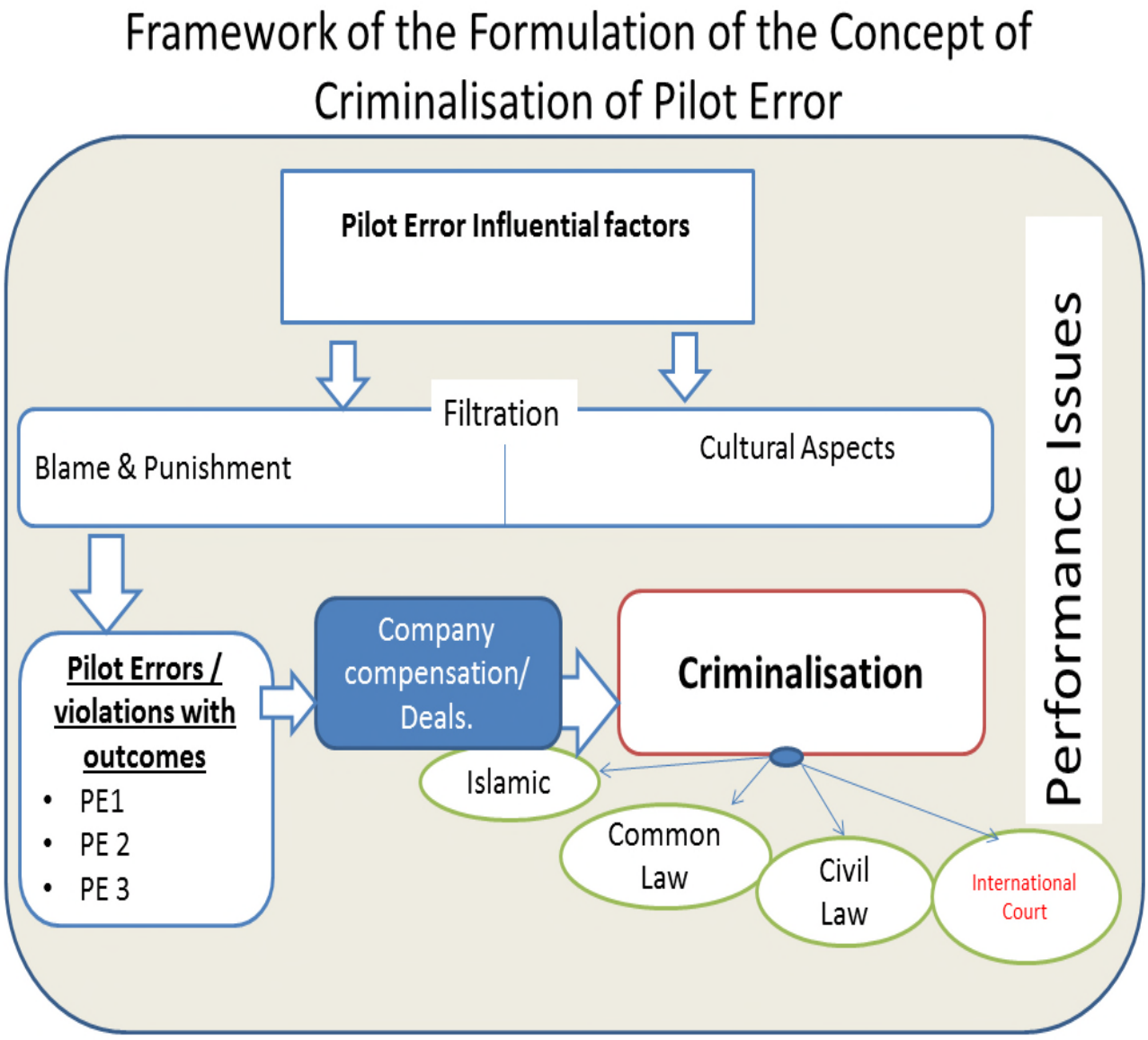

Figure 4: Initial framework

4 DATA COLLECTION AND ANALYSES

4.1 Qualitative data

Part of the questionnaire survey, that collected 107 responses, contained open ended questions to aid in delivering the research objective. Cohen and Crabtree (2006) suggested using semi-structured interviews, which in this case are replaced by open ended questions, as these may offer an excellent opportunity to collect qualitative data. As used in many research disciplines, Simons et al. (2018) recently used semi structured interviews containing open ended questions as a dependable method of data collection for their study. For the purposes of this research, response coding was used to analyse and process the qualitative data collected using open ended questions. Both inductive and deductive approaches were applied in analysing the qualitative data of the two main questions with six subheadings, followed by the identification of the themes and sub themes (Bryman, 2016; De Noronha, Coca-Stefaniak and Morrison, 2017; Simons et al., 2018).

4.1.1 Questionnaire qualitative data

The questionnaire survey had 42 questions, where they had multiple choice answers except question 10 of the survey had place for respondents to comment on these following statements.

Q9 – The ICAO’s definition of an error is "an action or inaction by an operational person that leads to deviations from organisational or the operational person’s intentions or expectations". ICAO’s definition of a violation is "a deliberate act of wilful misconduct or omission resulting in a deviation from established regulations, procedures, norms or practices". Do you think aviation professionals should be punished for committing errors? Please justify your answer.

- Do you think aviation professionals should be punished for committing errors?

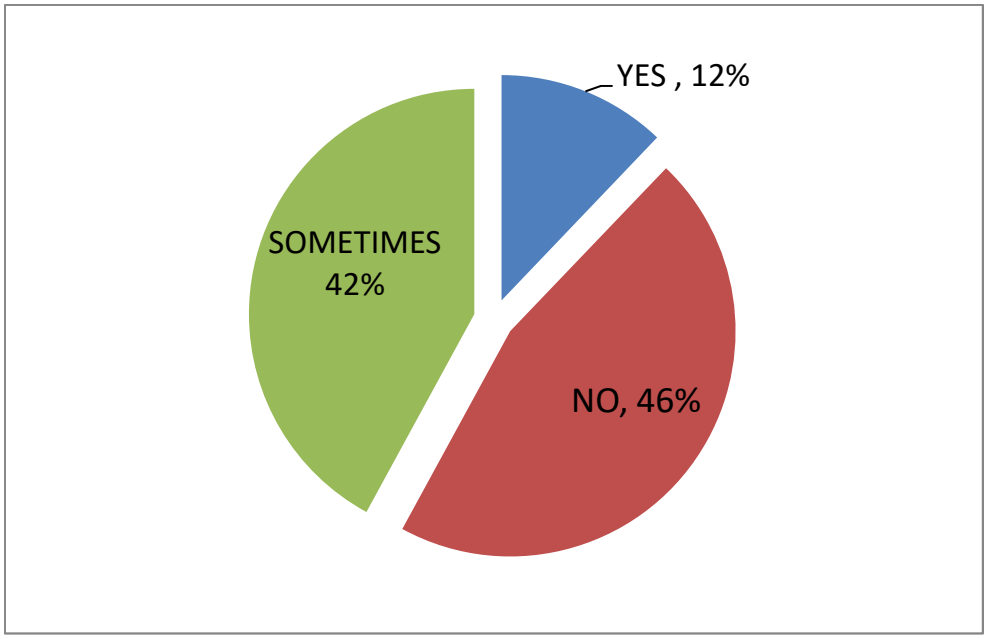

Figure 5: Percentages of agreement regarding punishment for committing errors.

The pie chart above shows the percentage of people who answered the question about whether aviation professionals should be punished for committing errors. There was 42% of people who said that sometimes aviation professionals should be punished for committing errors, while only 12% of people said that aviation professionals should be punished for committing errors. However, the highest percentage was people who said that no, aviation professionals should be punished for committing errors, which was 46%.

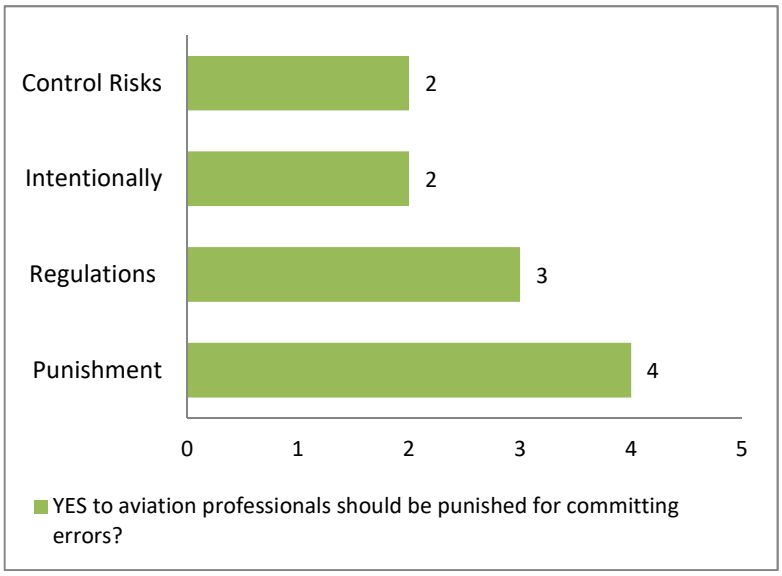

Figure 6: YES to "should aviation professionals be punished for committing errors?"

The above bar chart shows the number of people who agreed and the reasons behind this answer. There were four people who said that pilots should be punished but not lose their job if the error did not lead to a life-threatening situation, and they replaced this by punishment of the pilots within the company. Also, the bar chart shows that three people prefer to punish just to follow regulation and Laws. Two people said that it is important to have severe punishments to control the risk of others making the same errors. Moreover, two people also stated that some professionals commit errors intentionally because of external or internal issues.

Figure 7: NO to "should aviation professionals be punished for committing errors?"

- Figure 7 illustrates the motives behind the negative answer to the question. The bar chart divides the answers into two categories. The first one, which is the lowest as seven people answered to it, said that the errors were unintentional, as they are simply a mistake and not deliberate. However, the highest percentage of people (19%) said that it is human nature and, if pilots do not make such errors, how is it possible to learn? Therefore, those people encouraged the making of mistakes and errors in order to learn from them. Lastly, around 13 people said that no punishment should be involved but training is needed to improve the pilots' performance and stop such errors from happening again.

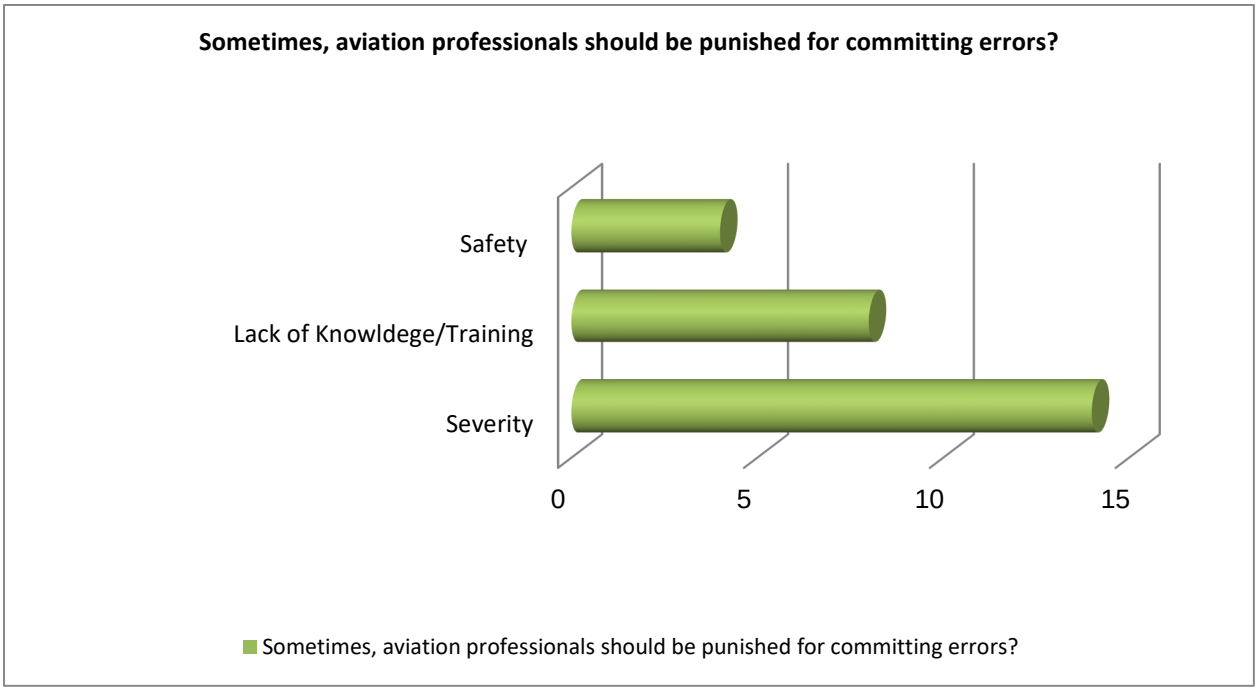

Figure 8 : SOMETIMES to "should aviation professionals be punished for committing errors?"

Figure 8 shows that people answered that sometimes punishment is required, as 14 people (the highest number) stated that it depended on the severity and level of the error. However, only four people said that sometimes it is necessary to punish pilots if the safety of the passengers and humans were put at risk. However, eight people stated that there was a lack of knowledge and skills that pilots need to maintain.

- Do you think aviation professionals should be punished for committing violations?

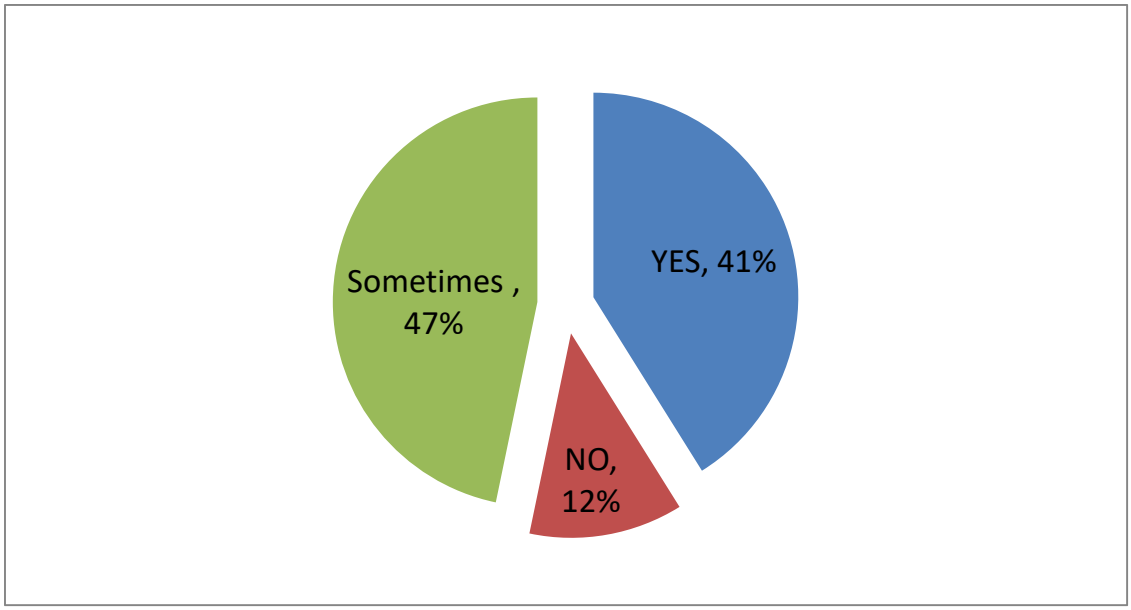

Figure 9: Percentage of agreement about punishment of committing violations.

- The Pie Chart above shows the percentage of people who answered the question about whether aviation professionals should be punished for committing violations. There were 41% of people who agreed that aviation professionals should be punished for committing errors, while only 12% of people said that they should be punished for committing errors. However, the highest percentage was for people who said that sometimes aviation professional should not be punished for committing errors (47%).

Figure 10: YES and NO to "should aviation professionals be punished for committing violations?"

- Figure 10 shows that only one person said that no punishment should occur for committing violations. However, 11 people said that they should be punished because the errors were committed intentionally, while 18 people said that they should be punished so that no one else will break the law and this will prevent such events happening again in the future. Moreover, severity is only three, which depends on the circumstances.

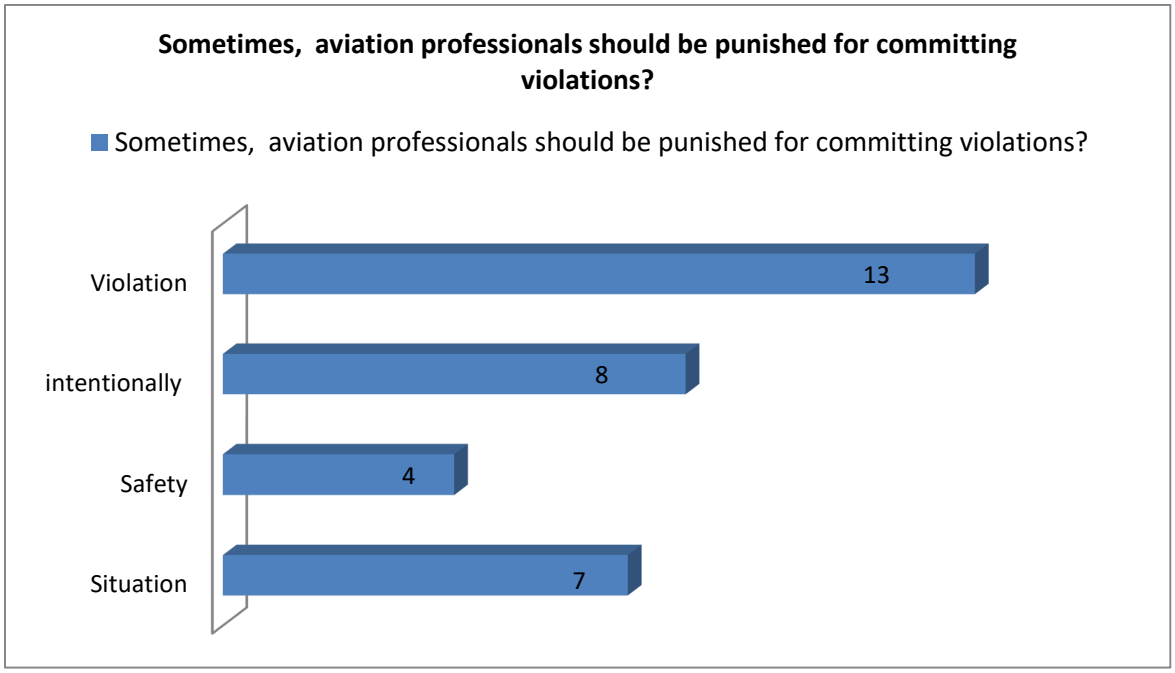

Figure 11: SOMETIMES to "should aviation professionals be punished for committing violations?"

- Figure 11 shows that only four people said sometimes pilots should be punished because of health and safety, seven people said that it depended on the situation in which the violation occurred, eight people said that sometimes punishment is required if it intentionally happened and, lastly 13 people agreed about the punishment of violations.

4.2 Quantitative Data Reliability and Validation

The questionnaire has been validated by aviation and research professionals including Prof. Braithwaite and other subject matter experts, who commented on the initial pilot study, after which the questionnaire was optimised. Where the variables correspond to statements that define each factor and the coding of the variable was directly taken from the Qualtrics survey software, the variables and their corresponding codes are explained in details in the appendix section 7.3.3.

4.2.1 Data Reliability and Internal Consistency

Factors analysis was conducted to assess internal consistency and test reliability (Moutinho, 2014; Rourke and Hatcher, 2013). The data were tested by

a multiple-items domain using Cronbach's alpha (in section 4.2.2) to measure the degree, items on the same domain, correlate with each other. As well as, modified item-to-total correlations; to measure the degree items correlate with the total score on its domain.

The four domain were defined for the purpose of this research as

1- Personal Power-distance.
2- Organisational Power-distance.
3- Punishment and prosecution.
4- The influence of CoPE on training.

Applying Pearson correlation coefficients, the reliability and internal consistency was tested on all four domains, in the following sections (Schober, Boer and Schwarte, 2018; De Winter, Gosling and Potter, 2016).

4.2.2 Personal Power-distance factor

Table 2: Personal Power-distance factor

Correlation coefficient for the specific factor	Correlation coefficient for the total degree	Variable
-.020-	.209	12_1
.468**	.582**	15_5
-.141-	-.081-	15_16
.173	.108	16_7
.208	.457**	16_8
.440**	.607**	16_9
.264*	.539**	16_10
.016	-.011-	16_11
.211	.517**	16_12
.351**	.548**	18_6
.381**	.574**	18_4
.464**	.677**	18_7
.451**	.601**	18_8
.303**	.314**	20_1

*Denotes P value is less than .05, and **denotes that the P value is less than .01

Table 2 shows that there is internal validity and reliability for all 14 statements except for two statements. This suggests the validity of data collected for the first factor.

4.2.1.2 Organisational Power-distance Factor

Table 3: Organisational power-distance factor

Correlation coefficient for the specific factor	Correlation coefficient for the total degree	Variable
.203	.049	Q15_14
.308**	.477**	Q15_13
.513**	.698**	17
.442**	.729**	21_1

**denotes that the P value is less than .01

As shown in table 3 that there is internal validity and reliability for all four statements except for the second statement. This suggests the validity of data collected for the second factor.

4.2.1.3 Punishment and prosecution factor

Table 4: Punishment and Prosecution Factor

Correlation coefficient for the specific factor	Correlation coefficient total degree	Variable
.365**	.423**	12_2
.324**	.441**	12_4
.253*	.348**	12_6
.155	.288**	12_7
.301**	.316**	12_8
.320**	.357**	12_9
.086	.140	13_1
.071	.173	13_2
-.088-	.139	13_3
.005	.123	13_4
.361**	.504**	13-5
.781**	.911**	14_4

*Denotes P value is less than .05, and **denotes that the P value is less than .01

As shown in table 4 that there is internal validity and reliability for all 13 statements (Variables) at 0.01 except for four statements (variables). This suggests the validity of data collected for the third domain.

4.2.1.4 The influence of CoPE on training factor

Training is very important and it needs to be addressed. In this survey there are two questions that addressed the influence of criminalisation of pilot error on training.

Table 5: Influence of CoPE on Training Factor

Correlation coefficient for the specific factor	Correlation coefficient total degree	Variable
.510**	.632**	14_7
.307**	.713**	14_9

**denotes that the P value is less than .01

Table 5 shows that there is internal validity and reliability for all two statements (variables) at 0.01. This suggests the validity of data collected for the fourth factor.

4.2.1.5 The following relationships were identified

Table 6: Relationships

Correlation coefficient for the total score	Factor
.643**	First
.741**	Second
.803**	Third
.598**	Fourth

**denotes that the P value is less than .01

Table 6 shows the results are between (0.803 and 0.598) which are significant at 0.01. This suggests that it is a valid and reliable tool to measure such variables.

4.2.1.6 Cronbach's Alpha

Table 7: Cronbach's Alpha data

Cronbach's Alpha	Factor
.434	First
.523	Second
.547	Third
.223	Fourth
.632	All Factors

The Cronbach's alpha is within the acceptable rates (Taber, 2018).

4.2.2 Characteristics of the sample

Table 8: Responders' Characteristics

Aviation Organization	Frequency	Percent
Full-service carrier	33	38.4
Regional carrier	38	44.2
Regulator	4	4.7
Other, please specify	11	12.8
Total	86	100.0

Table 9: Responders' Type of Work

Type of work	Frequency	Percent
Engineering	2	2.3
Flight Operations (pilot)	71	82.6
Flight Operations (cabin crew)	7	8.1
Regulator	2	2.3
Investigator	4	4.7
Total	86	100.0

Table 10: Experience of the Responders

Years of experience	Frequency	Percent
0-5 Years	42	48.8
6-10 Years	15	17.4
11 Years - more	29	33.7
Total	86	100.0

Table 11: Responders' Location

Base location	Frequency	Percent
The Middle East & North Africa	46	53.5
Central & South African countries	5	5.8
Australia, New Zealand, & Oceania	1	1.2
The Indian Sub-content	1	1.2
Europe	5	5.8
North America	28	32.6
Total	86	100.0

Table 12: Responders that Worked Internationally

Have you ever worked outside of your home country?	Frequency	Percent
Yes, please explain	36	41.9
No	50	58.1
Total	86	100.0

Table 13: Responders Worked that in another Role

Have you ever worked in other roles within the aviation industry?	Frequency	Percent
Yes, please specify	40	46.5
No	46	53.5
Total	86	100.0

Table 14: Responses That Express Agreement with Punishment for Committing Unintentional Errors

Do you think aviation professionals should be punished for committing unintentional errors?	Frequency	Percent
Yes, please explain why	12	14.0
No, please explain why	40	46.5
Sometimes, please explain why	34	39.5
Total	86	100.0

Table 15: Responses that Express Agreement with Punishment for Committing a Violation

Do you think aviation professionals should be punished for committing violations?	Frequency	Percent
Yes, please explain why	38	44.2
No, please explain why	7	8.1
Sometimes, please explain why	41	47.7
Total	86	100.0

4.2.3 Hypotheses and tests

To better illustrate the information provided by the collected data, a set of hypotheses were created and tested for each of the above factors.

1- What are the opinions of the sample regarding personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation?

2- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (location of the operations base)?

3- Are there correlations and/or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (type of profession)?
4- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (years of experience)?

To answer these hypotheses, four questions were derived with tables containing the means, standard deviations and ranking for each statement and its 5 point response-intensity scale as follows (5 - 4.21) strongly agree, (4.2 – 3.41) agree, (3.4 – 2.61) neither agree nor disagree “neutral”, (2.6 – 1.81) disagree, and (1.8 – 1.0) strongly disagree. The elaboration is in the following section 4.2.4.

4.2.4 Means and standard deviations

A- What is the representation of the opinions of the sample regarding **personal power-distance**, organisational power-distance, blame and punishment, training, and criminalisation?

Mean 1 representing the opinions of the sample regarding personal power-distance.

Table 16: Personal power-distance

NO.		Mean	Std. Deviation	Paragraph order	Degree of representation
1	The following statements address the adherence to Standard Operating Procedures (SOPs). - Intentionally deviating from Standard Operating Procedures (SOPs) should not be tolerated, for example if a crew elected not to read a checklist.	1.78	1.045	12	Strongly disagree
2	The following statements address management style influence. - Knowing that I might be prosecuted if deviating from procedures caused an accident. I might still deviate from SOPs, if I was instructed to do so by my supervisors.	3.91	1.204	3	Agree
3	The following statements address management style influence. - I am likely to follow SOPs, even if not supported by my supervisors.	1.70	.721	13	Strongly disagree
4	The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - I expect to be consulted on matters that affect the performance of my duties.	2.02	.811	11	Disagree
5	The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - Senior staff deserve extra benefits and privileges.	2.71	1.115	10	Neither agree nor disagree
6	The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - Captains or managers who encourage suggestions from crew members are weak leaders.	4.19	1.251	2	Agree
7	The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - Junior Flight crew members should not question the captain's or senior crew member's decisions.	4.40	.997	1	Strongly agree

8	The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - Crew members share responsibility for prioritizing activities in high workload situations.	1.55	.645	14	Strongly disagree
9	The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - In abnormal situations, I rely on my superiors to tell me what to do.	3.81	1.035	4	Neither agree nor disagree
10	The following statements address cultural factors within the work environment. - The captain should take physical control and fly the aircraft in emergency and non-standard situations. In other words, superiors or senior employees should take charge in non-standard or emergency situations.	2.93	1.156	8	Neither agree nor disagree
11	The following statements address cultural factors within the work environment. - Successful flight deck management is primarily a function of the captain's flying proficiency	2.97	1.222	7	Neither agree nor disagree
12	The following statements address cultural factors within the work environment. - Crew members should not question the decisions or actions of the captain except when they threaten the safety of the flight.	3.48	1.234	6	Agree
13	The following statements address cultural factors within the work environment. - There are no circumstances (except total incapacitation) where the first officer should take command from the captain.	3.59	1.259	5	Agree
14	Which one of the above styles of leadership would you most prefer to work under? - Style 1	2.87	1.196	9	Neither agree nor disagree
	Overall factor (Mean 1)	2.99	.47025	-	Neither agree nor disagree

From table 16 that addresses personal power-distance and has 14 statements, it was observed that statement number 7, “The following questions are aimed to get your opinion regarding different cultures and their influence on day-to-day operations. Please answer based on your agreement with each statement. - Junior Flight crew members should not question the captain's or senior crew member's decisions”, was the highest with a mean of (4.40) and a standard deviation of (0.997) at “strongly agree”. This was followed by statement number 6 which has a mean of (4.19) and a standard deviation of (1.251) at the scale of “agree”. The lowest statement was statement number 8 with a mean of (1.55) and a standard deviation of (0.645) at the scale of “strongly disagree”, preceded by statement number 3 that has a mean of (1.70) and a standard deviation of (0.721). The overall mean of this factor that consists of 14 variables is Mean 1 (2.99) with a standard deviation of (0.47025) at the scale of “neither agree nor disagree”.

The above results imply a fluctuation in the opinion of the sample and the need for the further investigation of personal power-distance.

B- What are the opinions regarding personal power-distance, **organisational power-distance,** blame and punishment, training, and criminalisation?

Mean 2 is the opinions of the sample regarding organisational power-distance.

Table **17** :Organisational power-distance

		Mean	**Std. Deviation**	**Paragraph order**	**Degree of representation**
1	The following statements address management style influence. - Questioning and/or correcting the actions or opinions of senior staff or managers is normal within my organization.	2.70	1.085	3	Neither agree nor disagree
2	The following statements address management style influence. - Questioning and/or correcting actions or opinions of senior staff or managers is NOT normal within my organization.	3.16	1.167	2	Neither agree nor disagree
3	How frequently, in your work environment, are subordinates afraid to express disagreement with their superiors?	3.47	1.070	1	Agree
4	In your organization, which one of the above styles do you find yourself most often working under? - Style 1	2.22	1.250	4	Disagree
	Overall factor (Mean 2)	2.8866	.56706	-	Neither agree nor disagree

Table 17 addresses organisational power-distance based on four statements, where statement 3 was the highest with a mean of (3.47) and standard

deviation of (1.070) at the scale of “agree”. The next highest, was statement 2 with a mean of (3.16) and standard deviation of (1.167) at the scale of “neither agree nor disagree”. The third is statement 1 with a mean of (2.70) and a standard deviation of (1.085), and the lowest was statement number 4 with a mean of (2.22) and standard deviation of (1.25) at the scale of “disagree”. The overall factor had a mean of (2.89) and a standard deviation of (0.567) at the scale of “neither agree nor disagree”.

C- What are the opinions regarding personal power-distance, organisational power-distance, **blame and punishment**, training, and **criminalisation**?

•Mean 3 is the opinions of the sample regarding blame, punishment, and criminalisation.

Table**18** : Blame, Punishment, and Criminalisation

		Mean	Std. Deviation	Paragraph order	Degree of representation
1	The following statements address the adherence to Standard Operating Procedures (SOPs). - The fear of being punished by the company makes me follow SOPs.	3.16	1.235	9	Neither agree nor disagree
2	The following statements address the adherence to Standard Operating Procedures (SOPs). - The fear of being punished by aviation authorities makes me follow SOPs.	3.15	1.306	10	Neither agree nor disagree
3	The following statements address the adherence to Standard Operating Procedures (SOPs). - The fear of being prosecuted by a court influences my performance on a normal flight.	3.19	1.279	8	Neither agree nor disagree
4	The following statements address the adherence to Standard Operating Procedures (SOPs). - The possibility of being reported, e.g. for non-adherence to SOPs, has a POSITIVE influence on my performance. (For example, the thought of being reported for not complying with ATC instructions, makes me perform better.)	3.28	1.214	4	Neither agree nor disagree
5	The following statements address the adherence to Standard Operating Procedures (SOPs). - The possibility of being reported, e.g. for non-adherence to SOPs, has a NEGATIVE influence on my performance. (For example, the thought of being reported for not complying with ATC instructions, makes me perform worse.)	3.36	1.051	2	Neither agree nor disagree
6	The following statements address the adherence to Standard Operating Procedures (SOPs). - My fear of being reported or prosecuted for deviations from SOPs has increased in the past five years.	3.20	1.206	7	Neither agree nor disagree

7	The following statements address the normal routine tasks. - Some countries prosecute aviation professionals for “not doing the job right”.	3.48	1.585	1	Agree
8	The following statements address the normal routine tasks. - The fear of being prosecuted is higher in some countries than others.	3.07	1.734	12	Neither agree nor disagree
9	The following statements address the normal routine tasks. - In the course of my daily routine, the fear of prosecution may interfere with the way I perform.	3.28	1.224	5	Neither agree nor disagree
10	The following statements address the normal routine tasks. - If there was continuous management presence in the workplace, the way I perform tasks will be different.	3.12	1.278	11	Neither agree nor disagree
11	The following statements address the normal routine tasks. - Deviation from Standard Operating Procedures (SOPs) is necessary sometimes in order to expedite routine tasks.	3.21	1.347	6	Neither agree nor disagree
12	The following statements address training. - I am reluctant to delegate tasks to newly hired staff, as if they have made any mistakes, I might be held accountable.	3.31	1.14	3	Neither agree nor disagree
	Overall factor (Mean 3)	3.2262	.60443		Neither agree nor disagree

Table 18 contains 12 statements that address the fear of blame, punishment, and criminalisation. It was observed that statement number 7 was the first with a mean of (3.48) and a standard deviation of (1.585) at the scale of “agree”. This was followed by statement number 5 with a mean of (3.36) and a standard deviation of (1.051). However, the last statement was statement number 8 with a mean of (3.07) and a standard deviation of (1.734), preceded by statement number 10 that has a mean of (3.12) and a standard deviation of (1.278). Both statements 8 and 10 are on the scale of “neither agree nor disagree”. The overall factor has a mean of (3.2262) and a standard deviation of (0.60443). This suggests the instability of the results for this factor, which will be addressed in the discussion chapter.

D- What are the opinions regarding personal power-distance, organisational power-distance, blame and punishment, **training**, and criminalisation?

Mean 6 is a representation of the opinions of the sample regarding training.

Table19 : Influence of Criminalisation on Training

		Mean	**Std. Deviation**	**Paragraph order**	**Degree of representation**
1	The following statements address training. - I like to train my new colleagues, even if it is not my duty to do so.	2.09	1.002	2	Disagree
2	The following statements address training. - Training will be negatively affected if human error was prosecuted.	2.21	1.107	1	Disagree
	Overall factor (mean 6)	2.1512	.71154	-	Disagree

Table 19 addresses the sample's opinions regarding training with two statements, the first being statement number 2 with a mean of (2.21) and a standard deviation of (1.107) at a scale of "disagree" followed by statement number 1 with a mean of (2.09) and a standard deviation of (1.002) also at a scale of "disagree", with the overall factor being at a mean of (2.1512) and a standard deviation of (0.71154) at a scale of "disagree". This result suggests the need for further investigation of this outcome in the discussion chapter.

4.2.5 Descriptions of hypotheses

Question 2- Are there differences that are statistically significant between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (location of operations base)?

To answer this question the following hypotheses were invented to address each factor.

To address the first factor (personal power-distance) 2 two hypotheses are stated

The alternative hypothesis: There are differences between the opinions of the sample with respect to personal power-distance, and criminalisation due to the variable (location of operations base).

The null Hypothesis H_o: There are no differences between the opinions of the sample with respect to personal power-distance, and criminalisation due to the variable (location of operations base).

Table 20: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.391	5	.878	4.877	.001
Within Groups	14.405	80	.180		
Total	18.796	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig. <0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

There are differences between the opinions across the sample with respect to personal power-distance, and criminalisation due to the variable (location of operations base).

Question 2 A

The null hypothesis H_o: There are no differences between the opinions across the sample with respect to organisational power-distance, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions across the sample with respect to organisational power-distance, due to the variable (location of operations base).

Table 21: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.236	5	.647	2.149	.068
Within Groups	24.096	80	.301		
Total	27.332	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

There are no differences between the opinions across the sample with respect to organisational power-distance, due to the variable (location of operations base).

Question 2B-

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame, punishment, and criminalisation, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame, punishment, and criminalisation, due to the variable (location of operations base).

Table 22: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.582	5	.316	.614	.689
Within Groups	41.213	80	.515		
Total	42.795	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

There are no differences between the opinions across the sample with respect to blame, punishment, and criminalisation, due to the variable (location of operations base).

Question 2C-

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame, and punishment, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame, and punishment, due to the variable (location of operations base).

Table 23: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.825	5	.165	.255	.936
Within Groups	51.724	80	.647		
Total	52.549	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2D-

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to criminalisation, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions of the sample with respect to criminalisation, due to the variable (location of operations base).

Table 24: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.715	5	.543	1.258	.290
Within Groups	34.532	80	.432		
Total	37.247	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2E-

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to criminalisation and training, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions of the sample with respect to criminalisation and training, due to the variable (location of operations base).

Table 25: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.334	5	.267	.512	.766
Within Groups	41.701	80	.521		
Total	43.035	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2F-

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (location of operations base).

To test these hypotheses a Chi-Square test was suitable and the results were as follows:

Table 26: Chi-Square Test Data

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.858[a]	10	.739
Likelihood Ratio	7.685	10	.660
Linear-by-Linear Association	.230	1	.632
N of Valid Cases	86		

13 cells (72.2%) have expected count less than 5. The minimum expected count is .14.

A Chi-square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2G-

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (location of operations base).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (location of operations base).

To test these hypotheses a Chi-Square test was suitable and the results were as follows:

Table 27: Chi-Square Test Data

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.679[a]	10	.912
Likelihood Ratio	6.167	10	.801
Linear-by-Linear Association	.453	1	.501
N of Valid Cases	86		

a. 14 cells (77.8%) have expected count less than 5. The minimum expected count is .08.

A Chi-square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 3

Are there correlations and/or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

3A- To answer this question two hypotheses were tested:

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to personal power-distance, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to personal power-distance, due to the variable (profession).

Table 28: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.744	4	1.436	8.912	.000
Within Groups	13.052	81	.161		
Total	18.796	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig<0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

There are differences between the opinions of the sample with respect to personal power-distance due to the variable (profession).

To investigate the statistical differences a Shefe test was performed to highlight the following

There is a statistical difference between the means of pilots and cabin crew which is highlighted by a significance level .05 or less. This suggests the need for further investigation of this correlation.

Table29 : Statistical Difference between the Means of Pilots and Cabin Crew

	Engineering	sig	Flight Operations (pilot)	sig	Flight Operations (cabin crew)	sig	Regulator	sig	Investigator	sig
Engineering			.89336	.056	.23469	.970	.57143	.731	.17857	.992
Flight Operations (pilot)	-.89336-	.056			-.65867-*	.003	-.32193-	.869	-.71479-*	.023
Flight Operations (cabin crew)	-.23469-	.970	.65867*	.003			.33673	.894	-.05612-	1.000
Regulator	-.57143-	.731	.32193	.869	-.33673-	.894			-.39286-	.864
Investigator	-.17857-	.992	.71479*	.023	.05612	1.000	.39286	.864		

*. The mean difference is significant at the 0.05 level.

Table 29 illustrates a Shefe test, which is used to investigate statistical significance between different variables. As shown above, there is a difference that is statistically significant between pilots and cabin crew, suggesting that further investigation is needed for this relationship.

3B- Are there correlations and/or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

To answer this question two hypotheses were tested:

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to organisational power-distance, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to organisational power-distance, due to the variable (profession).

Table 30: ANOVA Test of Alternative Hypothesis Data

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.287	4	.572	1.849	.128
Within Groups	25.045	81	.309		
Total	27.332	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig. >0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

There are no differences between the opinions of the sample with respect to organisational power-distance due to the variable (profession).

Question 3C –

- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

To answer this question two hypotheses were tested:

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame, punishment, and criminalisation due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame, punishment, and criminalisation, due to the variable (profession).

Table 31: ANOVA Test of Alternative Hypothesis Data

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.071	4	.768	2.223	.074
Within Groups	27.982	81	.345		
Total	31.054	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig. >0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3D- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

To answer this question, two hypotheses were tested:

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame, punishment, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame, punishment, due to the variable (profession).

Table 32 : ANOVA Test of Alternative Hypothesis Data

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.926	4	1.482	2.574	.044
Within Groups	46.623	81	.576		
Total	52.549	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig. <0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

To further investigate this correlation and those statistical differences a Shefe test was conducted to highlight those correlations as follows:

Table33 : Statistical Difference between the Means of different professions

	Engineering	**sig**	**Flight Operations (pilot)**	**sig**	**Flight Operations (cabin crew)**	**sig**	**Regulator**	**sig**	**Investigator**	**sig**
Engineering			.37887	.975	-.12857-	1.000	-.20000-	.999	-.65000-	.912
Flight Operations (pilot)	-.37887-	.975			-.50744-	.586	-.57887-	.888	-1.02887-	.149
Flight Operations (cabin crew)	.12857	1.000	.50744	.586			-.07143	1.000	-.52143-	.877
Regulator	.20000	.999	.57887	.888	.07143	1.000	-		-.45000-	.976
Investigator	.65000	.912	1.02887	.149	.52143	.877	.45000	.976		

*. The mean difference is significant at the 0.05 level.

In table 33 which displays the Shefe test was unable to highlight the specific clear correlations and statistically significant differences, for the sample on its own. However, there are statistically significant differences in general, due to the specific profession.

3E- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

- To answer these question two hypotheses were tested

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to criminalisation, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to criminalisation, due to the variable (profession).

Table 34: ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.115	4	.529	1.219	.309
Within Groups	35.132	81	.434		
Total	37.247	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig. >0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3F- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

- To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to training and criminalisation, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to training and criminalisation, due to the variable (profession).

Table 35: ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.302	4	.826	1.683	.162
Within Groups	39.733	81	.491		
Total	43.035	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3 G- The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (profession).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 36: Chi-Square test results

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.879[a]	8	.157
Likelihood Ratio	13.857	8	.086
Linear-by-Linear Association	4.435	1	.035
N of Valid Cases	86		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is 28.

A Chi-square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3H – The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (profession).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (profession).

To test these hypotheses a Chi-Square test was suitable and the results were as follows:

Table 37: Hypothesis Chi-Square Test Values

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.610[a]	8	.293
Likelihood Ratio	9.860	8	.275
Linear-by-Linear Association	.636	1	.425
N of Valid Cases	86		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is 16.

A Chi-square test was performed to test those hypotheses, where the above table illustrates that there is a difference with statistical significance (sig. < 0.05) that exists, which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

Question 4 - Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (years of experience)?

4 A- To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences between the opinions of the sample with respect to personal power-distance, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to personal power-distance, due to the variable (years of experience).

Table 38: ANOVA Test of Alternative Hypothesis Data

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.969	2	.985	4.856	.010
Within Groups	16.827	83	.203		
Total	18.796	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig. <0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

To further investigate this correlation and those statistical differences a Shefe test was conducted to highlight those correlations as follows

Table 39 : Statistical Difference between the Means of different levels of experience

	0-5 Years	sig	6-10 Years	sig	11 Years - more	sig
0-5 Years			-.09252-	.792	.28794*	.034
6-10 Years	.09252	.792			.38046*	.034
11 Years - more	-.28794-*	.034	-.38046-*	.034		

*. The mean difference is significant at the 0.05 level.

The statistical difference was observed to be significant between years of experience (0-5 years) and (11 years or more). Therefore, the data suggests that a correlation exists between personal power-distance and years of experience.

4B – The null hypothesis H_o: There are no differences between the opinions of the sample with respect to organisational power-distance, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to organisational power-distance, due to the variable (years of experience).

Table 40: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.419	2	1.209	4.029	.021
Within Groups	24.914	83	.300		
Total	27.332	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig. <0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

To further investigate this correlation and those statistical differences, a Shefe test was conducted to highlight those correlations as follows

Table **41** : Correlation and Statistical Differences of the Data

	0-5 Years	**sig**	**6-10 Years**	**sig**	**11 Years - more**	**sig**
0-5 Years			.04405	.965	.36474*	.026
6-10 Years	-.04405-	.965			.32069	.190
11 Years - more	-.36474-*	.026	-.32069	.190		

*. The mean difference is significant at the 0.05 level.

There was statistical significance between people who had 0-5 years of experience and those with 11 or more years of experience. Therefore, the data suggests that a correlation exists between personal power-distance and years of experience.

4C – The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame, punishment, and criminalisation, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame, punishment, and criminalisation, due to the variable (years of experience).

Table 42: ANOVA Test Results

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	.944	2	.472	1.301	.278
Within Groups	30.110	83	.363		
Total	31.054	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig. >0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 D – The null hypothesis H_o: There are no differences between the opinions of the sample with respect to blame, and punishment, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame, and punishment, due to the variable (years of experience).

Table 43: ANOVA Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.266	2	.133	.211	.810
Within Groups	52.283	83	.630		
Total	52.549	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4E – The null hypothesis H_o: There are no differences between the opinions of the sample with respect to criminalisation, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to criminalisation, due to the variable (years of experience).

Table 44: ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.036	2	1.018	2.400	.097
Within Groups	35.211	83	.424		
Total	37.247	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 F- The null hypothesis H_o: There are no differences between the opinions of the sample with respect to training and criminalisation, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to training and criminalisation, due to the variable (years of experience)

Table 45: statistically significant differences between the opinions of the sample with respect to training and criminalisation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.297	2	.148	.288	.750
Within Groups	42.738	83	.515		
Total	43.035	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig.

>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 G- The null hypothesis H_o: There are differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (years of experience).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 46: Chi-Square Test Results

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.681[a]	4	.794
Likelihood Ratio	1.697	4	.791
Linear-by-Linear Association	.666	1	.414
N of Valid Cases	86		

a. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 2.09.

4H- The null hypothesis H_o: There are differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (years of experience).

The alternative hypothesis: There are differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (years of experience).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 47: Chi-Square Test Results

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.769[a]	4	.067
Likelihood Ratio	8.967	4	.062
Linear-by-Linear Association	5.368	1	.021
N of Valid Cases	86		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is 1.22.

A Chi-square test was performed to test those hypotheses, where the above table illustrates that there is no statistically significant difference (sig. >0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4.3 Focus Group

The focus group was conducted with four pilots who have flown in more than ten countries around the globe.

The optimum set size has been discussed in the literature, and various authors have proposed different sizes. While a big set (>15) offers better, richer data, it might be challenging to run and to make certain that all members contribute (Barbour and Kitzinger, 1999; Romm, 2017). Furthermore, with group sizes of three or fewer, it is easier to attain more diverse and active collaboration amongst the members, as the group size is not too big to manage or too small to control (Guest et al., 2017; McKenna, 1994). The study's participants included four airline pilots in the focus group, with a combined experience of over 45 years.

4.3.1 Focus Group Participation

Each member of the group was selected based on their role in aviation, as an airline pilot; pilots were chosen because they are the ones who commit errors and so are best placed to elaborate on this subject, due to their everyday involvement. Pilot error and the criminalisation of investigation findings are best tested by pilots to find out if violations were involved. However, pilots follow established aviation laws by the respective country's authority, which are suggested by the International Civil Aviation Organisation ICAO. Due to the sensitivity of the information, the researcher decided to keep the identities of those airline pilots and their respective airlines anonymous (ICAO, 2016).

4.3.2 Focus Group Facilitation

The group was hosted in Jeddah, Saudi Arabia, where the researcher was the mediator. The questions were displayed on a screen and the group had the chance to discuss among themselves the different topics arising from each question. The group members were asked if they had any objections to being voice-recorded, but none were provided.

4.3.3 Focus Group Questions

The focus group were asked the following questions:

1- Do you think there is a need for a framework to guide the airlines about the issue of pilot errors in aviation?
2- Do you know what is the procedure or law of pilot error in aviation?
3- Do you know any comprehensive list of pilot errors?
4- What are the external and internal influential factors which affect the pilot, and cause them to commit errors in aviation systems? How can the pilot override such errors?
5- What are the consequences if the pilot committed an error in aviation? How would the airlines deal with such error?
6- What compensation and/or offers do the airline provides to the victims' families?

4.3.4 Focus Group Findings

1- Do you think there is a need for a framework to guide the airlines about the issue of pilot errors in aviation?

The focus group agreed on the need to establish a framework to address pilot errors and their subsequent outcomes. The group members were aware of the fact that pilots were punished, blamed, and criminalised for errors. The issue was discussed and the group debated the lack of standards in the company, where aviation organisations should have their own standards to address the issue of pilot error. Organisations should address the pilot error issue internally by the providing some guidelines/training.

2- Do you know what is the procedure or law of pilot error in aviation?

The group discussed the lack of an established standard to address the different pilot errors. For example, they discussed Saudi Arabia as an example, where the General Authority of Civil Aviation (GACA) has neither established laws nor regulations to address pilot errors with outcomes. Instead, such cases would have to go through the regular courts, especially if a corrective action by the company was taken against an employee; a pilot, in this case. Some group

members had experienced the loss of a family member on duty due to an aviation disaster, but they were not compensated by the company properly and struggled to secure their deceased family member's rights, so the group suggested the establishment of a specialised court of civil aviation.

3- Do you know any comprehensive list of pilot errors?

The group also discussed pilot errors, and agreed with the list presented:

A. Errors in communication; i.e., miscommunication is one of the biggest sources (Bearman et al., 2010; Harris and Li, 2008; Wiegmann and Shappell, 2000; Yacavone, 1993).
B. Cognitive errors; i.e. forgetting procedures, which lead to errors (Kirwan, 1994, p.87).
C. Ergonomics and systems design; i.e. accidents resulting from engineering failures, where the error is a product of the design (Braithwaite, 2017; Dekker, 2003; Rankin, 2018; Tuttle, 2015).
D. Aeromedical; i.e. physiological conditions, illnesses and fatigue (Wiegmann and Shappell, 2001b).
E. Psychosocial or perceptual errors; i.e. when a pilot makes an error but cannot admit it (Wiegmann and Shappell, 2003). This also includes psychological factors affecting mental operations (i.e. from stimulus input to response execution) which lead to errors in decision-making (Cohen et al., 2018; Bearman et al., 2010; Reason, 2005, 1997; Hawkins and Orlady, 1993; Wickens and Flach, 1988).
F. Organisational factors (Lawrenson and Braithwaite, 2018; Strauch, 2015; Morrow, Kenneth and Barnes, 2014; Braithwaite, 2011; Bird, 1974). This includes procedures, training and/or the environment, including the organisational environment (Tuttle, 2015; Dekker, 2011). Alternatively, this could also include violations. Since they are part of each organisational practice in procedures, violations mean basically following the wrong procedure (Wiegmann and Shappell, 2012).
G. "Intent" Failure to achieve their intended outcome (Reason, 2017; Hughes and Kornowa-Weichel, 2004). Failures during the actual

execution of actions (Reason, 2017; Hughes and Kornowa-Weichel, 2004). Failures during the actual execution of an action or speech (Kirwan, 1994, p.87).

H. Poor personal status, which includes the mental status of the pilots (Lyu, Xiao and Zhou, 2018).
I. Characteristics and sociotechnical cockpit performance; this is partly genetic and partly learned through experience and education (Lyu, Xiao and Zhou, 2018).
J. Neither knowledge nor experience obtained from training and one's personal experience (Cohen et al., 2018).
K. Failure to address contextual factors or consider the organisational factors in performance (Cohen et al., 2018).
L. Accidents occur when there is a breakdown in the group dynamics and interpersonal communications between the aircraft crew (Wiegmann and Shappell, 2000; Yacavone, 1993)

The group added things to this list that were not mentioned in the literature:

1. Being bored or not in the right mood.
2. Scheduling.
3. Overconfidence.
4. Personality and habits.
5. Companies should be responsible for unforeseen circumstances.
6. Communication (has many branches and sections).
7. Routine.
8. Lack of manual flying skills.
9. Not planning for flight.
10. Pilots being poorly trained.

The group also gave many examples of each category, and elaborated on the above list of errors.

4- What are the external and internal influential factors which affect the pilot, and cause them to commit errors in aviation systems? How can the pilot override such errors?

The group also discussed the internal influential factors, such as more stress might be needed sometimes to increase vigilance. Having the right mind-set and always asking “what if” questions were also thought to be important, since incidents and accidents happen when least expected. Some pilots need to visualise the whole flight to plan it properly, and be ready physically and mentally to stay ahead, since complacency could lead to accidents.

5- What are the consequences if the pilot committed an error in aviation? How would the airlines deal with such error?

Companies should study pilot error scenarios and teach their pilots how to avoid such errors; however, some errors are unavoidable and airlines should be ready to accept that. Also, aviation organisations should increase the awareness of their employees regarding how to avoid the outcomes of such errors.

6- What are the compensation and offers that the airline provides to the victims’ families?

The group discussed that companies are usually unfair when it comes to the families of their affected employees, especially the national carriers in the Middle East. One participant had a family member who lost his life while on the job and, unfortunately, they were not given their rights and had to fight for airlines to show appreciation to their employees. Airlines were also observed as failing to honour their contract with their employees when it came to on-the-job

injuries. Passengers are also affected by this, where property damage such as a lost bag may not be given fair compensation unless passengers fight for this. The group argued that aviation organisations should honour their role by giving the right compensation to any affected party, whether a passenger or an employee. The discussion of this topic made some group members become emotional, since it directly affected their lives.

4.4 Interviews Qualitative Data

Subject Matter Experts (SMEs) were defined for the purposes of this research as pilots with more than 15 years of experience, who had been involved in aviation incidents and/or accident investigations. The interview candidates were chosen for the purposes of this research as pilots with more than 15 years of experience in aviation from different parts of the world. The purpose of the SME interviews was to validate the CoPE framework to see if it was easy to understand, if all the elements of pilot error were addressed, and if it was a practical framework to apply in the aviation industry. Interviewee 1 had more than 30 years of experience, had served as a captain for more than two airlines, and was involved in a major aviation accident investigation. Interviewee 1 gave valuable feedback on the CoPE framework, where he suggested that a new layer might be added to the filtration process. As illustrated in figure 12 below, a layer was added before the blame, punishment, and cultural aspects to include organisational factors, such as the organisational safety department practices, including the protection, identification, and mitigation of common and reoccurring errors. Interviewee 1 elaborated that errors should not be punished under any circumstance, since they do not have the intention of causing any harm. He also elaborated that sensitive information such as CVR and DFDR should not be made public, and should only be used for safety related purposes.

Interviewee 2 had more than 30 years of experience, had worked in both the military and civil aviation sectors and had also served as a captain for more than two major airlines. He was also involved in a major aviation accident investigation that involved pilot error. Interviewee 2 criticised the CoPE for being

general with errors and violations. He suggested that more explanation of the presented elements of the CoPE framework to be given, especially the filtration layer of the blame, punishment, and cultural aspects. He added that this layer could be separated into two parallel elements instead of the current one, as shown in the illustration below.

Figure 12: Factors that may influence pilot error.

Interviewee 3, who has been flying for the past 25 years, currently serves as a captain on Airbus A-320, and had worked in both civil and military aviation, applied a valuable critique to the presented framework, as he requested the addition of organisational factors preceding the filtration layer of the blame, punishment and cultural aspects. He also requested the separation of the blame, punishment and cultural aspects into two independent and parallel elements instead of being a whole block, as illustrated above.

Interviewee 4, who is a lawyer specialising in international business, suggested adding a layer in the framework as a matrix called compliance consequences that was then divided into different branches:

1- Compliance

2- Rule liability, which is divided into three types (a-) criminal liability (b-) contractual liability (c-) tort liability

3- Jurisdiction

4- Engaged stakeholders

   a) Airlines

   b) Government organisations

   c) Semi-government organisations

5- Applicable law.

Interviewee 5 liked version 2 (V2), as illustrated in figure 12, of the framework since it had a separate filtration layer of FDM for error mitigation. However, he suggested adding colours to the layout and a few more details. This interviewee has been flying for more than 15 years, with experience in Europe, the USA, the Indian subcontinent, and the Middle East.

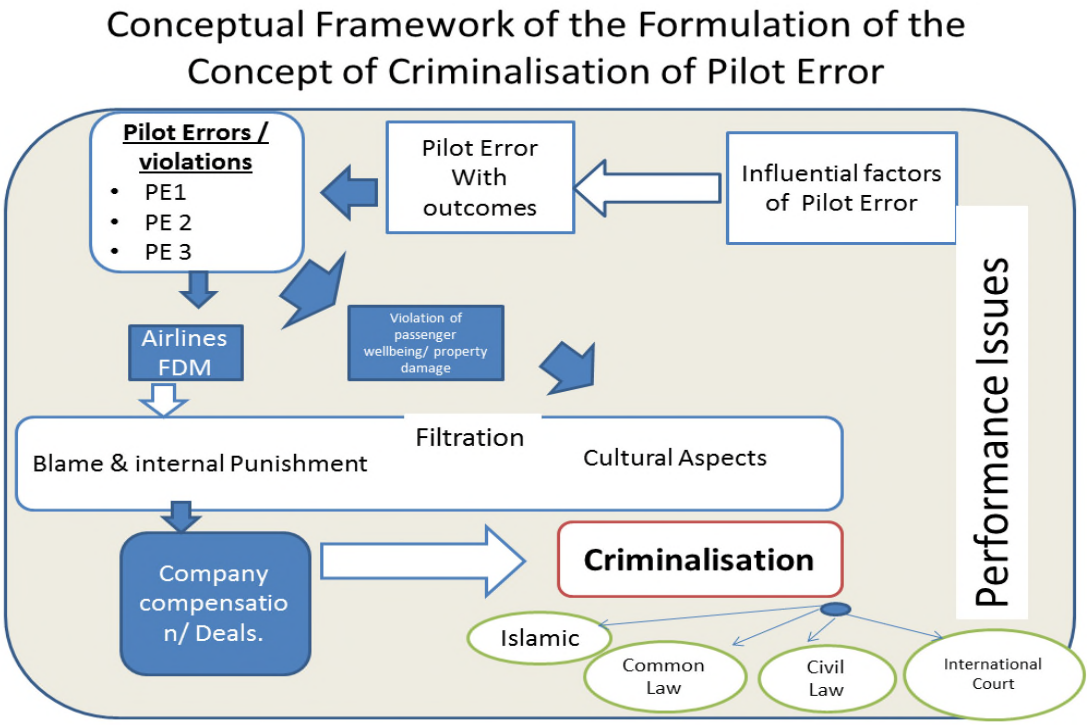

Figure 13: Version 2 (V2) of the CoPE framework

Interviewee 6 had more than 30 years of experience in aviation and had served as a captain for many different transports category airplanes, in addition to being a simulator examiner, training manager and aviation safety inspector in the civil aviation authority of a country in the Middle East. He commented on the

framework, and suggested that the current layer of the influential factors of pilot error might be expanded and elaborated to include legal aspects, blame and punishment. He suggested a distinction between the regulations and company procedures of the aviation organisations, some of which were sometimes deviated from due to operational reasons. However, he acknowledged the fact that the aviation industry requires some guidelines regarding addressing the topic of pilot error and its implications. He also provided many examples of deviations from procedures that are done by the maintenance, dispatch, and other departments, all of which fall under the category of pilot error, and are counted against pilots in any investigation.

Interviewee 7 is a captain for a prestigious European national carrier and has a PhD in aviation accident investigation; he recommended the idea of the framework as a guideline for safety investigators. He also suggested that to increase the applicability and validity of this framework, layers and numbers might be added as representative values instead of qualitative representation.

4.5 Discussion of the results

4.5.1 The Final framework of Criminalisation of Pilot Error CoPE

The final framework for the Criminalisation of Pilot Error (CoPE) consists of eight layers containing elements to guide independent safety investigators to address pilot error in the aviation community and try to prevent the escalation of such errors from reaching criminal courts.

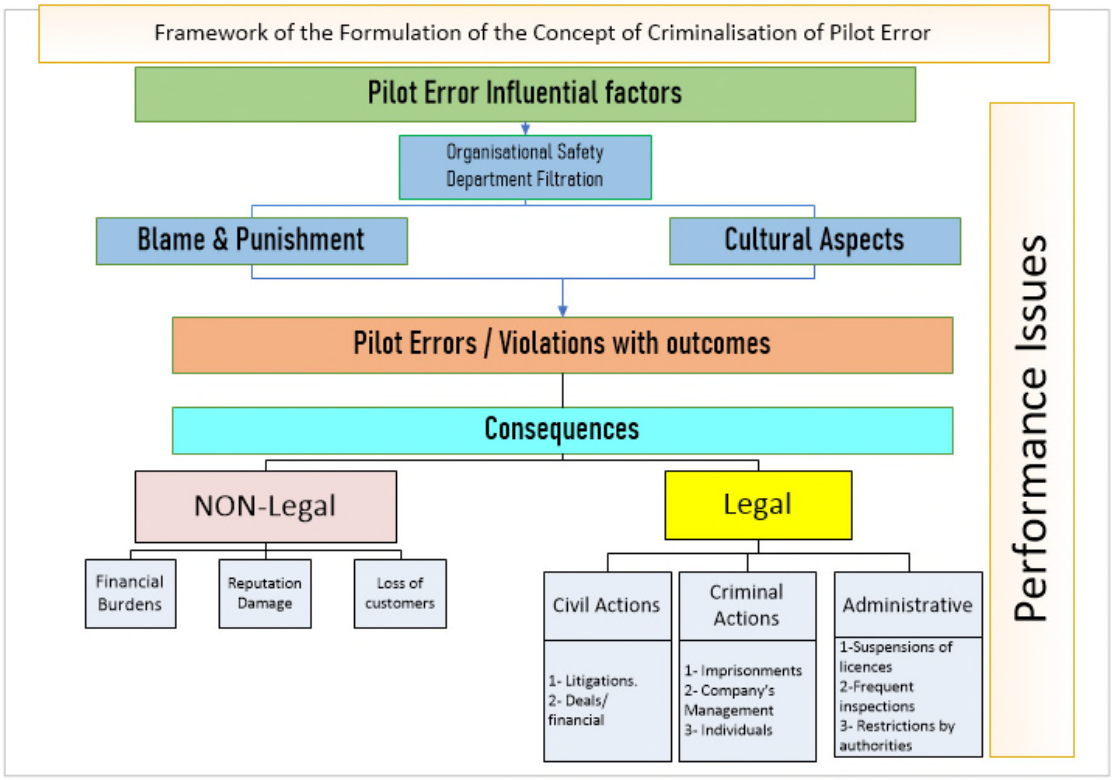

Figure 14: Final Criminalisation of Pilot Error CoPE Framework

4.5.2 Pilot error influential factors;

4.5.2.1 Issues to consider in determining pilot error influential factors

These influential factors are determined by accident investigators. However, it is very important to note that investigation teams differ in terms of their level of experience and background. For example, if scheduling was an issue, and the investigator had no flying experience, his/her judgement would be less accurate than if he/she had had flying experience, and so on. Therefore, in many events it is possible to prove a counter argument due to misjudgements made by the investigators, which is why aviation accident investigations are an on-going issue and files could be reopened and facts re-examined.

It is also important to consider the need and/or demand for entities to defend pilots. Take for example the US Airways accident and the subsequent water landing, where the captain was initially blamed for failing to consider alternatives near New York's La Guiardia Airport when, in fact, the captain justified that it would have been impossible to land the airplane safely in time

with the unusual dual-engine flameout. The NTSB, after listening to the captain, agreed to his claims and changed their judgement regarding the probable cause of the accident. This example shows that misjudgements are very common, especially with investigators with no flying experience. It is also important to note that, in some countries with civil laws, a civil judge is responsible for determining the causes of accidents and issuing sentences for people who are found guilty of causing them. Aviation investigators were called to testify as expert witnesses in order for those judges to issue their sentences; this contradicts the ICAO's annex 13, which clearly specifies that accident investigations' facts and reports should not be used to apportion blame but instead to help prevent similar incidents and accidents from happening again in the future (Omar, Johari and Samad, 2018; Michaelides-Mateou and Mateou, 2016; ICAO, 2016; Hicks et al., 2015; Suhir, 2013; NTSB, 2010).

Another important issue that could play a role in the judgements of investigators is training, where it is known in aviation that an intentional deviation from procedures is a violation. However, if pilots were trained to make such deviations, why should they be blamed and perhaps even criminalised for doing so? A good example is rejecting a take-off after the decision speed. It is established that pilots should never reject any take off after reaching that speed. In some instances, with a dual engine flame out, the aircraft would not even get off the runway, let alone land safely. This illustrates that every incident and/or accident is unique and should not be judged using generic and standard judgments. In many accidents, the pilots are deceased and/or not given the opportunity to defend or justify themselves. The point here is that any judgment can be wrong, which is why nothing should be final.

The classification for pilot error was adopted from many sources, as well as, the focus group and the interviews outcomes; where similar errors were grouped together as follows:

1. Errors in communication, miscommunication is one of the biggest sources (Bearman et al., 2010; Harris and Li, 2008; Wiegmann and Shappell, 2000; Yacavone, 1993). This category has different layers;

a) Misuse of the standard phraseology.
b) Misunderstanding of proper English.
c) Errors in pronunciation.

2. Cognitive errors, errors that are born from thought-processes errors, or thinking mistakes, which lead to incorrect analyses, actions, or both (Stiegler et al., 2012; Kirwan, 1994 p.87). This layer also has different sub-layers:
   a) Forgetting procedures.
   b) Focusing on an issue and disregarding other important things.
   c) Availability bias; a choice that is closest to someone's mind.
   d) Premature closure; accepting a decision prematurely, failing to consider the different reasonable options.
   e) Feedback bias; misinterpretation of a lack of feedback as good feedback.
   f) Confirmation bias; seeking or acknowledging only information that confirms the desired or suspected outcome.
   g) Framing effect; subsequent thinking is swayed by leading aspects of the initial presentation, listening to colleagues and others' opinions on a specific situation.
   h) Commission bias; tendency toward action rather than inaction, performing un-indicated manoeuvres and deviating from protocol, possibly due to overconfidence, desperation, or pressure from others.
   i) Overconfidence bias; inappropriate boldness, failing to recognize the need for help, a tendency to believe we are infallible.
   j) Omission bias; hesitation to start emergency procedures due to a fear of being wrong or causing harm, a tendency towards inaction.
   k) Sunk costs; an unwillingness to let go of a failing diagnosis or decision, especially if much time/resources have already been allocated (ego may play a role here).
   l) Visceral bias; counter-transference i.e our negative or positive feelings about a situation influence our decisions.

m) Unpacking principle; a failure to consider all relevant information, especially during the transfer of airplanes.

3. Ergonomics and systems design, i.e. accidents resulting from engineering failures, where error is the product of the design (Braithwaite, 2017; Dekker, 2003; Rankin, 2018; Tuttle, 2015).
4. Aeromedical; physiological conditions, illnesses and fatigue (Wiegmann and Shappell, 2001b). This has many branches such as:
   a) Misuse of over-the-counter medication.
   b) Tiredness and fatigue.
   c) Chronic conditions.
   d) Medication for chronic conditions.
   e) Circadian rhythms, day and night operations.
   f) Diet.
5. Psychosocial errors (Wiegmann and Shappell, 2012). These include the following psychological factors:
   a) Mental operations, from stimulus input to response execution.
   b) Errors in decision-making (Cohen et al., 2018; Bearman et al., 2010; Reason, 2005, 1997; Hawkins and Orlady, 1993; Wickens and Flach, 1988).
   c) Poor personal status, which includes the mental status of pilots (Lyu, Xiao and Zhou, 2018).
6. Organisational factors (Lawrenson and Braithwaite, 2018; Strauch, 2015; Morrow, Kenneth and Barnes, 2014; Braithwaite, 2011; Bird, 1974), which include:
   a) Procedures.
   b) Training.
   c) Environment, including the organizational environment (Tuttle, 2015).
   d) Violations; since they are part of each organizational practice in procedures, violations are basically following the wrong procedure (Wiegmann and Shappell, 2012). They are also called systemic errors, or acceptable deviations known to the crew, and are accepted as normal.

The group added this list that was not pointed out in the literature:

13. Mood:

i. Feeling bored.
ii. Not having the right mind setting.
iii. Same routine.

14. Scheduling:

i. Too many shifts in a very short time.
ii. Not assigning the right rest duties.

15. Personality:

i. Habits.
ii. Planning, or not planning.

16. Unforeseen circumstances:

i. The company does not want to take responsibility.
ii. The company took responsibility.

17. Lack of manual flying skills:

i. Manufacturers' recommendation.
ii. Company procedures.

The group also gave many examples of each category, and elaborated on the above list of errors.

4.5.3 Organisational Safety Department

This filtration level is crucial to mitigate the outcomes of pilot error; this layer to catch errors from making it the next layer. For example, aviation organisations often mandate pilots to undertake training in the wake of incidents and/or Flight Data Monitoring (FDM) events. Pilots, however, depending upon their respective culture, may perceive this as an act of punishment rather than a supportive action by the airlines. Based on the researcher's observation of the aviation industry, in High Power-Distance HPD cultures, especially in Far-Eastern and Middle-Eastern countries, pilots usually perceive extra training as a

punishment. This silence carries with it a high risk of affecting the safety culture. In Low Power-Distance LPD cultures, however, pilots usually consider this as a supportive action by the company (Dismukes, 2017a). This takes this issue to the specific culture, blame and loss face; depending on the culture itself.

4.5.4 Blame and Punishment

Conversely, HPD cultures encompass some qualities that would avoid the consequences of pilot error from expanding; for instance, when a co-pilot "first officer" flies with a senior captain, in HPD cultures, errors are typically found and corrected silently, hence pointing out an error is considered disrespect in such cultures. The opposite is usually true in LPD cultures, where errors are generally found and pointed out, then corrected in a more relaxed environment. This poses a cultural difference that should be considered by the aviation community (Reason, 2017).

As mentioned in the literature review section 2.3.3, those studies illustrate a clear relationship between aircraft accident rates and national culture (Al-Wardi, 2017; Li, Harris and Chen, 2007; Helmreich and Merritt, 2001; Jing, Lu and Peng, 2001). These studies concluded that national culture could have an impact on accident rates. However, caution is advised because the HFCAS, invented in the USA, may include in itself a type of cultural bias.

4.5.5 Cultural Aspects

The topic has been vigorously considered by academia; some authors argued that there is a strong relationship between HPD cultures and accident rates. More recent studies (Michaelides-Mateou and Mateou, 2016; Soeters and Boer, 2009; Harris and Li, 2008), such as Harris and Li (Harris and Li, 2008), have proved that aircraft accidents in Africa and Asia, regions that are regarded as having HPD, have five times more aircraft accidents than America and Europe, regions regarded as having LDP. Furthermore, the study demonstrated that, in Africa and Asia, one recurrent factor in the accident rates are failures regarding poor Crew Resource Management (CRM), which are 30 to 40-fold higher than the likelihood of errors in decision-making, perceptual errors, and violations in procedures (Wiegmann and Shappell, 2003). The reason behind this increment

could be that HDP nations consider questioning superiors as disrespectful, the relationship between managers and workers is formal and, sometimes, communication is restricted (Harris and Li, 2008).

The accident rates differ across the globe, with Asia and Africa generally having higher ones than Europe and North America (Arnaldo Valdés and Gómez Comendador, 2011; Harris and Li, 2008). Such a difference is usually attributed to a failure within Crew Resource Management (CRM). Those continents have high power-distance (HPD) cultures, a dimension that defines the power-distributed among a group of working individuals (Hofstede, 2001), in which questioning superiority is considered disrespectful, leading to power-distance.

4.5.6 Pilot Errors/ Violations with Outcomes

Criminalisation is normally associated with clear violations that are taken to court. Pilots are exposed to situations that make them commit or omit actions that are known as errors. Errors are usually treated differently, depending on their outcomes. Professionals would be put in jail, companies would incur huge fines. However, if those errors had no outcomes, nothing would happen, which is the main reason incident investigations are very important to detect errors and system flaws before any accident (Li and Harris, 2013). Unfortunately, it is looked at in a very different way by the general public; one accident could set the end to some companies, ground airplanes, and devastate people's lives. The Concorde accident in Paris, France was the one and only accident that actually was the main reason to ground the supersonic commercial jet; following the loss of trust by passengers (Reason, 2017; Michaelides-Mateou and Mateou, 2016).

4.5.7 Consequences

Companies have departments for handling customer/complains and settling cases. However, there is a certain timeframe in which the company must respond to such complaints, before they are elevated to court. This is an important filtration process, where people who are involved in such occurrences or their loved ones might respond positively when treated well.

The procedure for a complaint against airlines starts with the affected party taking the complaint directly to the airline or airport; the complaint should be in writing, specifying the time within which the airlines or airport must reply to the affected party. If the response from the airline is unforthcoming or dissatisfactory, then the affected party can refer their complaint to an alternative dispute resolution ADR body, CCA, or take direct legal action against the airline.

Both the ADR bodies and PACT will advise on whether they think the affected party has a valid complaint and, if so, will take it up with the business concerned. However, PACT cannot impose a decision on an airline while CAA approved ADR bodies can do so (CAA, 2015b).

4.5.7.1 Legal Consequences

Legal consequences are actions by a court of law. For example, suspending flying licenses, imposing fines, and jail sentences; they are divided into three main categories;

1- Criminal Actions; jail sentence.
2- Civil Actions; fines.
3- Administrative Actions; suspending flying licenses.

4.5.7.2 Non- Legal consequences

1- Reputation loss; the first stage of non-legal implications. Customers usually pay attention to accidents to specific companies; poor safety records could lead to financial implications.
2- Loss of customers; this depends on the company's way of dealing with crises, and how many accidents the company had. These are important factors in the after math of accidents.
3- Financial burdens; are the result of the previous stages of non-legal consequences, in most of accidents that is the sequence (Michaelides-Mateou and Mateou, 2016; Stoop and Dekker, 2012).

4.6 Case study validation

Case study validation by the application of the CoPE framework to hypothetical criminalisation examples is recommended by the research community to validate such a model (Balls, Worth and Combes, 2019):

- Case study 1 was an airplane landing in the Netherlands at Maastricht international airport, where the aircraft was scheduled and dispatched for a cargo flight from Jeddah, Saudi Arabia, on a Boeing 777-F. The planned departure time was 02:00 AM for a scheduled landing time at 07:00 AM. Even though the flying time was shorter than scheduled, the flight crew were advised by the local ATC to slow down and enter a hold since Maastricht Airport was still closed. The weather was deteriorating and a snowstorm was approaching the area. The airport had excellent handling, but only a single runway that can accommodate a Boeing 777-200F in normal conditions. However, during a snowstorm with degraded braking action, the runway can barely accommodate the heavy airplane. The flight was cleared to land, and the airplane had to taxi to the end of the runway and make a 180 degree turn in icy conditions. The crew had to stop and ask for ground support in order to ensure the airplane had adequate clearance. Both the captain and the first officer were tired since it was an overnight flight and neither of them had previous experience at this small airport, especially under these conditions.

The flight crew taxied the airplane slowly on slippery taxi ways into the ramp. Had the crew not been extremely vigilant, they could have easily ended up with an air disaster, since sliding off the taxi way would cause substantial damage to the airplane, along with property damage, and personal injuries, which constitutes an air disaster. This case was used to validate the COPE framework.

A- **The first layer is the influential factors regarding pilot error**; there were many clear examples of these, the first being the incorrect scheduled time of departure that allowed the airplane to arrive before the airport was even open. The second factor was operational, where the

crew were not provided with accurate weather information in order to assess the landing performance or if landing was even possible on this short runway in such deteriorating weather conditions. The third influential factor was that the airport metrological office did not provide airplanes with adequate and reliable forecasts at the time of arrival, that had made it very difficult for the crew to assess the situation at an early stage.

B- **The next layer is the organisation's safety department**; where the above mentioned factors were neither detected nor corrected by the safety department in that specific organisation; therefore, those events will make it to the next layer, which is blame and punishment or cultural aspects.

C- **Cultural aspects, blame and punishment;** those events had some culture related issues. The first cultural aspect was the fact that both the captain and the first officer were from a High Power-Distance (HPD) culture, in which questioning the actions of supervisors and/or managers may be considered disrespectful, and the age difference between the captain and the first officer was approximately 40 years. These two cultural aspects played an important role in such a situation but, important as they are, they were not detected by the system.

D- **Pilot error and/or violations with outcomes;** had the captain veered off the runway centreline and the first officer not said anything due to the above cultural aspects, there would have been pilot error with an outcome, which involves property damage and possibly the loss of life of ground personnel working on the ramp adjacent to the runway.

E- **Non-legal consequences;** the airlines would have had to pay for the damage caused at Maastricht Airport, in addition to the damage and delay regarding the cargo being carried by the airplane. Furthermore there is the reputation damage to consider, where customers in the future would not trust this airline to transport their goods in a safe, timely manner.

F- **Legal consequences;** the airline could receive fines and may even be prohibited from flying in Europe if safety breaches are found in their system. The pilots operating the flight might have their licences confiscated and suspended by EASA (the European Union Aviation Safety Agency). The next stage of the legal consequences would be the prosecution of the company executives with criminal sentences, such as corporate manslaughter or even manslaughter, if it was found that they could have done something to prevent such an accident from happening.

i. The family members of those employees who lost their lives went to court to sue the airlines for operating in such dangerous conditions, which involves negligence. The court ruled in their favour and the airline had to pay compensations, accounting for the pain and suffering caused to those families.

ii. Some family members backed up by some social media activists, pressed charges against the captain and the first officer for manslaughter due to operating in such dangerous conditions instead of diverting to a bigger, more suitable airport. This criminalisation case is subject to the Dutch law (a civil law system). Even though this case involved many international organisations, there is no unified international standard applicable to such a case, and the local Dutch civil law, was applicable to this case. Therefore, the judge in charge who did not know much about aviation and its complications, must now decide and issue or dismiss criminal sentences to pilots from a totally different part of the world who happen to operate in the Netherlands.

- Case Study 2 involves Airlines X, which was operating a flight between City Y, on the Mediterranean basin, and the UK. During the flight, unexpected air turbulence hit the airplane, causing damage in the cabin

and multiple passenger injuries. The pilots decided to divert and land in France due to the severity of some of the passengers' injuries. During this flight, several injuries happened. This led to complaints by several passengers. The following is a demonstration of the use of the proposed framework in order to evaluate if there was pilot error that could be considered a criminal action, and prevent the escalation of the matter to court.

i. **Pilot error's influential factors**; the pilots on this flight were operating several flights that day and were approaching eight hours of duty. They were found to be adequately trained and proficient. However, their schedule had changed many times before this flight, which has caused confusion among the flight crews. The dispatch department, which handles flight planning, did not provide adequate information on the turbulence forecast. The independent investigator officer could use the list of pilot influential factors in sections 2.3 and 4.2.4 that are related to this case. The identified factors are: pilot fatigue, lack of flight planning, and poor scheduling.

ii. **Organisational safety department**; the safety department did not properly monitor the dispatch department, and the scheduling department had known issues concerning shifting pilot duty times and fatigue cases. Moreover, it did not properly oversee the planning and dispatch department, where known mistakes were reported and would not be happy, since their job would be threatened, especially with turbulence forecast.

iii. **Blame and punishment, and cultural aspects**; the flight crew was paired in accordance to the company policies. Their airline company has a culture whereby pilots and crew members feel ashamed and disrespectful about reporting their fatigue. The pilot and crew members in this case thought that, if they had reported their fatigue, then the airline would not have been happy and their job would be threatened. Therefore, culture would play a very important role in this case.

iv. **Pilot error/Violations with outcomes;** Due to fatigue, the pilot was slow to take important actions. In this case, the pilot did not take precautionary measures in turning on the seat belt signs and advising the passengers and

cabin crew to be seated due to their passage through an area of air turbulence. The fact that they passed through turbulence, along with the omission of the seatbelt sign by the captain was the major cause of the passengers' injuries. This constitutes the layer of pilot error and/or violations with outcomes.

v. **Non-legal consequences;** after the safe landing of the airplane in France, some passengers started legal action against the airline, so the airline's representatives started to settle these cases and offer financial compensation which were successful in most cases.

vi. **Legal consequences**; some of the affected passengers chose to take their case to court instead and sue the airlines for mismanagement and negligence.

vii. **Criminalisation;** some passengers chose to seek litigation by suing the pilots for neglecting their duties as they owe a duty of care to the occupants of the airplane. There are different legal systems to address this case, and litigation sought in Greece or France will fall under civil law. However, litigation sought in the UK would be addressed under English common law. These differences show the lack of a unified aviation legal system to address such cases.

5 RESEARCH OUTPUT

5.1 Discussion of findings

Air transport has become one of the most popular, safest and fastest modes of transportation for the general public. Nowadays, the aviation sector has benefited from the use of advanced technologies in running airports and facilitating communications between stakeholders.

However, the key asset is still the people who run this transport industry. Although there are so many regulations and procedures regarding how things should be done, human error occurs throughout this process, and some of these errors are considered a criminal action to which people are held accountable by law. This PhD research has made a significant contribution to the evolving aspect of the criminalisation of human error, particularly pilot error. It addressed different aspects:

1. Aspects surrounding pilot error's influential factors.
2. Industrial perspectives.
3. Blame and punishment.
4. Cultural aspects.
5. Error filtration methods.
6. Pilot error/violations with outcomes.
7. Company compensation/deals.
8. Criminalisation of errors under the different judicial systems, including Islamic Law (which is similar to common law), Common Law, Civil Law and the International Court.

The study of the criminalisation of pilot error requires the definition of realistic and achievable research questions, aims, and scientific objectives. That is why the overall aim of this research was the formulation of the concept of the criminalisation of pilot error from the stakeholders' perspective.

In order to achieve the above aim, a practical research methodology was defined. Due to the range of stakeholders involved in the research on the criminalisation of pilot error, the researcher had to use different research

methods: a questionnaire survey, focus group, face-to-face interviews with subject matter experts, and case study validation.

These are some of the important findings:

The literature review addressed the issue on different levels and to various depths, such as the timeframe and the subject of the criminalisation of human error. This first started in the eighties, which defines the timeframe, and has rapidly increased in the past few years. However, the pilot sector is different, and the fact that many known cases of pilot error have ended in criminalisation in recent years is disturbing (Winter et al., 2020; Dekker, 2011; Flight Safety Foundation, 2006; Lawrenson and Braithwaite, 2018; Michaelides-Mateou and Mateou, 2016).

Despite the importance of the subject, there is no comprehensive definition or study of the concept of the criminalisation of Pilot Error (CoPE). However, those previous studies helped the author to identify the key elements that should be considered in the formulation of the concept of CoPE in this research, and below is a list of the key elements:

The main elements are the influential factors regarding pilot error, the filtration layers of organisational and cultural aspects, errors and violations with outcomes, compensation and/or deals with the affected parties, legal consequences and criminalisation. After the formulation of a framework based on a literature review, questionnaire, survey and focus group, the framework was then presented to subject matter experts for evaluation. The experts critiqued the framework and suggested the addition of another filtration layer. They also suggested the division of another layer to distinguish between cultural aspects and blame and punishment. Furthermore, to reduce the criminalisation of pilot error they suggested the addition of another element, which includes legal consequences before reaching the criminalisation stage; for example, property damage and/or any litigation seeking financial compensation. These refer to the illustration of the final framework in section 4.2.5 in the previous chapter.

When the above factors are disrupted by a pilot, there is a cultural issue within the airlines; this is called the blame and punishment culture, which is the first step to be addressed when it is identified by the airline themselves. This issue would be addressed in a different way, in a different manner by different airlines. What is clearly observed in this research is that the host nation of the airline, its culture and religion and the customs of the society or country have a major impact on how airlines deal with pilot errors.

The framework is a graphical representation of the key elements of the concept of the criminalisation of pilot error. The elements that constitute the framework and the elements were developed using the literature review and the interaction with the stakeholders in the aviation industry through conducting a field study.

These are some important findings of the questionnaire survey:

1- The study of Yi et al., (2015) provided an example of an LPD culture versus an HPD culture. Moreover, the conclusions of this study supported other studies (Hu et al., 2018; Oruh and Dibia, 2020; Murphy, Gordon and Anderson, 2004; Robbins, 2001). This suggests the possible applicability of such a study in the research on the influence of the perception of the concept of criminalisation on LPD versus HPD cultures. There are statistically significant differences between the opinions across the sample with respect to personal power-distance and criminalisation due to the variable (location of the operations base).

2- The literature also suggests that a correlation exists between the accident rate and the cultural factors of individualism and Power Distance (PD), which was also visible in other accidents such as Avianca 052 and Korean 801 (Tear et al., 2020; Winter et al., 2020; Chow, Yortsos and Meshkati, 2014; Gladwell, 2008). Another study takes a critical step towards establishing the view that safety culture is empirically correlated to safety performance (Morrow, Kenneth and Barnes, 2014). There are statistically significant differences between the opinions of the sample with respect to personal power-distance due to the variable (profession). The difference was found to be statistically

significance between the pilots and cabin crew; thus, supporting those studies that suggested that pilots have different points of view to cabin crew.

3- Gao et al. (2018) conducted a cross cultural study that resulted in proving the strong relationship between cultural power-distance and different countries, especially in consumers' reviews, that supports the findings of Mariani and Predvoditeleva (2019) and Lewis et al. (2011) who conducted a study in which cultural aspects were studied in the medical and hospitality fields. The conclusions of these studies showed that there was resistance to change in the culture, but that there is strong relationships between culture and people's choices, and how they conceive things. As supported by the study of Sax et al. (2009). Consequently, it is possible to influence culture; hence, culture is on-going and could be influenced by different external and internal factors. Therefore, the introduction of the criminalisation concept may have an influence on the safety culture within organisations, the impact of which should be examined. There are no differences that are statistically significant between the opinions across the sample with respect to organisational power-distance, due to the variable (location of the operations base), which thus contradicts some previous studies.

The aviation community needs to create solutions which help each case of pilot error that results in a violation of a passenger's rights. For example, some violations might cause a delay to the flight while, at the other extreme, deaths may occur due to accidents inside the plane, with the flight, or due to a crash. This is an area that needs further investigation and to be linked with facts obtained from previous accidents that have happened in different airlines all over the world.

5.2 Contribution to Knowledge

1- Created well-defined elements that cover all aspects of the criminalisation of pilot error.

2- A framework that helps to guide independent safety investigators to address and prevent the escalation of pilot error cases from reaching the court.
3- A detailed study addressing cultural aspects in different parts of the world and how these affect the concept of the criminalisation of pilot error.

This research tried to apply a strong judiciary study that is applicable to the criminalisation of pilot error in the aviation sector. However, there has been no comprehensive study that compiles the key factors that influence pilot error during the course of their duties because these factors are obscured by the authorities and airlines, so further work needs to be done in order to meet this requirement. Moreover, due to the lack of research in cultural aspects which influence pilot error, progress in this field is slow. This paper contributed to knowledge by laying a foundation of understanding what these cultural aspects may be and examining how they may affect pilots with regard to criminalising errors.

5.3 Limitations of the Research

1. Accessing the participants in the questionnaire and survey was difficult due to the fact that the survey was disseminated in the midst of the cyber-attacks that occurred in 2016. Only 86 usable responses were obtained out of 5,000 email invitations sent by the Information Technology (IT) Department.
2. Instead of being global (as planned) the responses were mainly from airlines based in the United States and the Middle East, due to the accessibility of pilots by the researcher.
3. The focus group participants were mainly from the Arabian Gulf area, due to difficult access to participants from other parts of the world.
4. Airlines are not very open about sharing information regarding pilot error and violations.
5. There is a lack of statistics available from the main aviation authorities in the world. Publicly accessible information (i.e. about the different accidents and incidents that have occurred) would help to identify the main issues associated with pilot error in the aviation industry

6. Another important issue is how pilot error is translated into crime. The legal aspects differ in different jurisdictions, such as civil law, common law and Islamic law, instead of there being a unified international legal standard to address pilot error.

5.4 Conclusions

1. Research on the criminalisation of pilot error cannot produce satisfying results without having a good interaction with the practitioners concerned, mainly pilots. Therefore, the present research was an excellent effort to interact with 5000 pilots in order to obtain primary information about the subject.
2. There is a root cause for each pilot error, so research in this area needs to have a comprehensive list of the influential factors that lead pilots to commit such errors. This research has made a good effort to provide such a list. However, it needs to be made more comprehensive, which may happen in the future.
3. An overview of the criminalisation of pilot error needs to be presented through graphs, diagrams and charts. Therefore, this research presented the framework clearly in figure 12. The proposed framework consists of the key elements and the connection between them based on the findings of the literature review and the data analysis based on the field study.
4. Although the literature review has addressed the topic of criminalisation of pilot error (CoPE), more work is required to provide a comprehensive study of the subject to reflect the new evolving issue and the legislation in the aviation sector. This research is a step towards achieving this.
5. This type of research would produce excellent results and outcomes with a high level of interaction between the aviation system and the pilots. However, with the difficulties encountered within the aviation industry, pilots were reluctant to participate in such research.

5.5 Future Work

Whilst this research has provided a good foundation for the concept of CoPE, more work needs to be done. Future work should aim to:

- To assess airlines all over the world, as this study only focuses on airlines in the Middle East.
- To cover more cases from most of the continents. Due to cyber-crimes that occurred in 2016, the majority of people who received online links were hesitant to open them, so insufficient data was gathered due to external influence.
- To organise with a public body to be able to easily collect data, and be able to obtain the needed the airlines' information more easily and openly.
- To cover more information from different countries regarding the legal aspects of blame and punishments.

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7 APPENDICES

7.1 Appendix A: Questionnaire survey and consent form

Participants were provided with the following consent form and survey through Qualtrics, which is a survey software used by Cranfield University, the survey is as follows:

Thank you so much for devoting your precious time in order to help my research into aviation safety. This research aims to measure awareness of human error and its consequences within the aviation industry. The following survey targets all aviation professionals, including regulatory agencies and those who retired within the past five years. Answers of retirees should be based on their last aviation role.

However, if you are not working within the aviation industry, **please do not complete this survey**. Thanks again, I very much appreciate your contribution.

The responses collected are completely anonymous and confidential, and will be used only for research purposes. This survey consists of five sections, and would take approximately 10 minutes to complete. If you decide to withdraw at any time you can do so by closing it. The responses collected are totally anonymous, and the answers are not identifiable. However, if you may change your mind and withdraw after the completion of the survey, please provide your email address in order to identify the responses, without doing so; the responses will not be identifiable in order to withdraw your responses.

1- What type of Aviation Company do you work for?

   A- Airlines B- Regional Airlines/Low cost C- Regulator
   D- Other, please Specify.

2- What is your current position?

   A- Engineer B- Pilot C- Regulator D- Other, Please Specify

3- How long have you worked for this organization?

A- 0-5 years B- 6-10 years C-10 years or more

4- Where is your operations based?
(The world map is displayed with the different geographical regions)

5- Are you working in your home country?

A- Yes B- No

6- Have you ever worked outside of your home country?

A- Yes, please explain B- No

7- Have you worked in other roles within the aviation industry?

A- No B- Yes, please specify

8- Did you work at other aviation organisations?

A- No B- Yes, please specify

9- Briefly describe your experience in aviation?

10- *ICAO's definition of an Error as; an action or inaction by an operational person that leads to deviations from organisational or the operational person's intentions or expectation.

*ICAO's definition of a Violation **"**a deliberate act of wilful misconduct or omission resulting in a deviation from established regulations, procedures, norms or practices.

Do you think aviation professionals should be punished for committing unintentional errors?
Why?

A- Yes, please explain
B- No, please explain
C- Sometimes, please explain

The following set of questions is aimed to get your opinion using the Likert scale. Please see the example below

11- The aviation industry is the safest mode of transportation, please choose one answer

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

12- Intentionally deviating from Standard procedures should not be allowed to happen, for example if the crew elected not to read a checklist.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

13- The fear of being punished by the company makes you follow SOPs.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

14- The fear of being punished by Aviation authorities makes you follow SOPs.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

15- The fear of being prosecuted by a court affects your performance on a normal flight.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

16- Adherence to SOPs is stronger in some countries, due to the possibility of being reported, will have a POSITIVE influence on your performance. For example, flying into a busy airport in a first- world country, the thought of being reported for not complying with ATC instructions, makes you perform better.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

17- Adherence to SOPs is weaker in some countries; due to the possibility of being reported will have a NEGATIVE influence on your performance. For example, flying into a busy airport in a first- world country, the

thought of being reported for not complying with ATC instructions, makes you perform worse.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

18- My fear of being reported or prosecuted for deviations from SOPs increased in the past 5years.

A- Strongly agree B- Agree C- Neither agree nor disagree D- Disagree E-Strongly disagree

19- It is well known that aviation laws, and local laws, are different across the world. Some countries prosecute aviation professionals for “not doing the job right”. This is apparent in particular countries. The fear of being prosecuted is higher in some countries.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

20- In the course of my daily routine, the fear of criminalisation may interfere with the way I perform.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

21- If there was continuous management presence in the workplace, the way I perform tasks will be different

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

22- I am reluctant to delegate tasks to newly hired staff, as if they have made any mistakes, I might be held accountable.

A- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

23- I like to train my new colleagues, even if it is not my duty to do so.

E- Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

24- Training will be negatively affected if human error is criminalized.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

25- Questioning and/or correcting actions or opinions of senior staff or managers is normal within my organization.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

26- Questioning and/or correcting actions or opinions of senior staff or managers is **NOT** normal within my organization.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

27- Knowing that I might be prosecuted if my mistakes or deviations from procedures caused an accident. I might still deviate from Standard Operating Procedures SOPs, if I was instructed to do so by my supervisors.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

28- I am likely to follow Standard Operating Procedures S.O.Ps, even if not supported by my supervisors.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

29- Deviation from Standard Operating Procedures SOPs is necessary sometimes in order to expedite routine tasks.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

The Following set of questions is aimed to get your opinion regarding the different cultures and their influence on our day-to-day operations.

30-I expect to be consulted on matters that affect the performance of my duties.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

31- Senior staff deserve extra benefits and privileges.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

32- Captains who encourage suggestions from crew members are weak leaders.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

33- Junior Flight crew members should not question the captain's or senior crew members' decisions.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

34- Crew members share responsibility for prioritizing activities in high workload situations.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

35- In abnormal situations, I rely on my superiors to tell me what to do.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

The Following set of questions is aimed to get your opinion regarding the different Organizational cultures and their influence on our daily routine tasks.

36- How frequently, in your work environment, are subordinates afraid to express disagreement with their superiors?

A- Always
B- Most of the time
C- About half the time
D- Sometimes
E- Never

37- The captain should take physical control and fly the aircraft in emergency and non-standard situations. In other words, superiors or senior employees should take charge in non-standard or emergency situations

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

38- Crew members should not question the decisions or actions of the captain except when they threaten the safety of the flight.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

39- There are no circumstances (except total incapacitation) where the first officer should take command from the captain.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

40- Successful flight deck management is primarily a function of the captain's flying proficiency.

A-Strongly agree B- Agree C- Neither agree nor disagree
D- Disagree E-Strongly disagree

The following set of questions is aimed to get your opinion on ideal management styles.

Please read the following descriptions of four different leadership styles, and rank them.

You can move the answers up and down and rank them in your own order

Style 1. Usually makes his/her decisions promptly and communicates them to his/her subordinates clearly and firmly. Expects them to carry out the decisions loyally and without raising difficulties.

Style 2. Usually makes his/her decisions promptly, but, before going ahead, tries to explain them fully to his/her subordinates. Gives them the reasons for the decisions and answers whatever questions they may have.

Style 3. Usually consults with his/her subordinates before he/she reaches his/her decisions. Listens to their advice, considers it, and then announces his/her decision. He/she then expects all to work loyally to implement it whether or not it is in accordance with the advice they gave.

Style 4. Usually calls a meeting of his/her subordinates when there is an important decision to be made. Puts the problem before the group and invites discussion. Accepts the majority viewpoint as the decision.

A- Which one of the above styles of leadership would you *most prefer* to work under:

1. Style 1
2. Style 2
3. Style 3
4. Style 4

B- In your organization, which one of the above styles do you find yourself most often working under :

1. Style 1
2. Style 2
3. Style 3
4. Style 4

Thank you so much for your time, please provide your email address below, if you would like to receive information regarding the final results of this survey.

Additionally, if you elect to withdraw from this survey in the future, you need to provide your email below in order to identify your responses.

Thanks again

7.2 Appendix B: Interview Consent Form and Ethics Form

Title of the project:	*Evaluation Of The Concept Of Criminalization Of Human Error In Aviation*
Name of the researcher:	Ahmed Bazaid
Researcher's contact details:	*a.s.bazaid@cranfield.ac.uk*
Participant number:	
Date:	

1. I confirm that I have been informed about the aim and objectives of this research project and agree to give my inputs.
2. I understand that all personal information that I provide will be treated with the strictest confidence and my name will not be used in any report, publication or presentation.
3. I understand that the data I provide will be used by Cranfield University for the purpose of research. It will be stored on a secure network accessed only by authorised users in accordance with the Data Protection Act (1998).
4. I have been provided with a participant number as shown above. The researcher(s) will record data against my participant number instead of recording my name. The file linking my name to my participant number will be accessible only to the two main researchers, and will be securely destroyed after 14 days.
5. I understand that I am free to withdraw from this project at any stage by informing a member of the research team, for whom contact details have been provided. I also understand that I can also withdraw my data for a period of up to 14 days from today, as after this time it will not be possible to identify my individual data from the aggregated results as explained in point 4.
6. Interviews will be recorded and securely stored on the Cranfield University network as audio files. These audio files will be securely deleted within a year of the end of the research.
7. The recordings will be transcribed and saved as text files. Identifiers such as name, age, and location will be removed/replaced during transcription.
   - *I am happy for my transcript to be published:* Yes ☐ No☐
8. An analysis of all results will be made in statistical software, aggregating results. Direct identifiers such as names will be excluded and all reasonable steps will be made to anonymise this data as far as possible.
   - *I understand that the final analysis will be published in support of the research findings*. ☐

I confirm that I have read and fully understand the information provided on this form and therefore give my consent to taking part in this research.

Participant's signature:		**Date:**	
Participant's name:			
Researcher's signature:		**Date:**	

Cranfield UNIVERSITY

Cranfield University Research Ethics System (CURES)

Part 1: Summary Details

Lead Researcher (Applicant)

Title	First Name	Surname
Mr	Ahmed saleh m	Bazaid

School: Aerospace, Transport and Manufacturing

Email: a.s.bazaid@cranfield.ac.uk

Lead Researcher status: (•) Student ( ) Staff

Course Enrolled

PhD

Please confirm which project type your application is supporting

- (•) Thesis
- ( ) Group Project
- ( ) Other

Co-Researcher

Title	First Name	Surname

School:

Email:

Short title of project

Human Error

Full title of project

EVALUATION OF THE CONCEPT OF CRIMINALIZATION OF HUMAN ERROR

Abstract

The aviation industry is one of the safest modes of transportation; due to the high standards and regulations that govern this industry. One of the methods which enhance aviation safety is aviation accident and incident investigation, where root causes and contributing factors are analysed to generate safety recommendations that would help in the prevention of future similar accidents. However, in the past few decades, an increasing trend was observed of criminalizing the actions or omissions of aviation professionals that contributed either directly or indirectly to the sequence of events leading to an aviation accident (Michaelides-Mateou and Mateou, 2010). Aviation professionals were taken into court in the wake of aviation accidents, and aviation accident investigators were also called to testify as experts to help judges find the truth, or justice for the affected parties.
Whether fair or not, the perception of the concept of criminalization of crew actions may have different effects on crew performance. A review of the relevant literature suggests that influences of people's perception of the concept of criminalization were not deeply investigated. Therefore, this research is aimed to address the different aspects that surround the concept of criminalization of errors committed by aviation professionals, and the consequences that arise after such punitive actions are taken against individuals. The published literature also suggests that culture may have an influence on people's view of this concept, with some exceptions, people of different cultures and backgrounds may understand it differently.

Lead Supervisor

Title	First Name	Surname
Professor	Graham	Braithwaite

School: Aerospace, Transport and Manufacturing

Email: g.r.braithwaite@cranfield.ac.uk

If the supervisor details above are missing or incorrect, please contact cures-support@cranfield.ac.uk and we will add or amend the information.

Do not sign the form in Part 6 until we have replied to you that the supervisor information has been updated.

Intended start date of project: 01/10/2016

Intended end date of project: 30/06/2017

Intended start date of data collection: 17/10/2016

Please note: you must not begin your research until approval has been given by CURES.

Will the research be sponsored or funded by an external organisation?

- ○ Yes
- ◉ No

Please click on 'Next' in left hand actions bar to move forward to Part 2

Part 2: Ethical Risk

The following questions will help determine the level of ethical risk that your project entails.

Firstly, please give us your own assessment of the ethical risk level of your project. The University has five risk levels (see help information). If you have any doubts as to which category is appropriate the higher risk category should be used.

Level 2b: Risks to the researcher/participant are no greater than those typically encountered in ordinary life

---

Please select any that apply:

- ☐ Living animals are involved in my research
- ☐ The research will use tissues from deceased animals that have been killed as part of the research project
- ☐ The research involves living organisms/biological agents and could potentially impact other entities outside the laboratory
- ☐ People may be seriously harmed in the course of the research
- ☐ The proposed research could adversely affect the reputation of the university
- ☐ The research data is about illegal activities or will be collected from those engaged in illegal activities, or has itself been collected illegally

- ☑ None of the above

Please select any that apply:

- ☐ The research will involve the collection and use of 'relevant material' under the Human Tissue Act 2004
- ☐ There are significant power differences present, or dual or other complicating relationships exist
- ☐ The research will deal with material that is obscene or violent in content
- ☐ The risk is greater than the participant normally experiences in their daily life
- ☐ The research interacts with members of potentially vulnerable groups (e.g. children, the elderly, those with learning difficulties, prisoners etc.)
- ☐ Harm for participants and/or researchers is likely (physical, emotional, psychological, career, financial)
- ☐ National infrastructure will be impacted negatively (e.g. power grid)

- ☑ None of the above

Please select any that apply:

- ☐ The research involves interviews with or surveys of human participants where sensitive personal, confidential or commercially-sensitive data will be gathered
- ☐ The research will use tissues from deceased animals that have come from the food supply chain, roadkill or an authorised source
- ☐ The research will use tissues from living animals that have come from normal husbandry, a therapeutic routine, or operation
- ☐ The research is based on unpublished material
- ☐ The research has defence or security implications

- ☑ None of the above

Please select any that apply:

- ☐ The research involves surveys or interviews with human participants who are fully able to provide their informed consent, and if applicable, organisational approval has been obtained for the employees of the organisation concerned to take part in the research
- ☑ The research consists of interviews, where any published or recorded material does not contain personal data, unless permission has been obtained for its use (for example, name, job title or years in post)
- ☑ Sensitive personal data will not be collected
- ☑ The research consists of surveys, which will not collect personal data or identifying information

- ☐ None of the above

If you are using animal tissue, please explain where it has come from. If it originates from an animal house provide the details of the university or other establishment in the box underneath and how they comply with the required Home Office approval; and under what license conditions

Will your research require obtaining informed consent?

- ○ Yes
- ◉ No
- ○ Not applicable

Will participants be able, during the data gathering phase, to freely withdraw or modify their consent and to ask for the destruction of all or part of the data that they have contributed?

- (•) Yes
- ( ) No
- ( ) Not applicable

Will your research adhere to the duty of confidentiality?

- (•) Yes
- ( ) No
- ( ) Not applicable

Are there any conflicts of interest?

- ( ) Yes
- (•) No
- ( ) Not applicable

Are you collecting commercially sensitive data?

- ( ) Yes
- (•) No

Please comment on any other ethical issues that may arise from your project

Please click on 'Next' in left hand actions bar to move forward to Part 3

Part 3: Methodology and Expertise

By completing the following information on your research methodology will help us match your application with the most appropriate reviewer(s).

What type of research design will you be using? (tick all that apply)

- [ ] Experimental
- [ ] Quasi-experimental
- [x] Cross-sectional or survey
- [ ] Longitudinal
- [x] Case study
- [ ] Comparative
- [ ] Other

What type of research strategy will you employ?

- ○ Qualitative
- ○ Quantitative
- ◉ Mixed methods

Which methods will you be using? (tick all that apply)

- ☐ Experimental - design
- ☐ Experimental - field
- ☐ Experimental - laboratory
- ☐ Randomized controlled trial / other intervention study
- ☑ Interview
- ☐ Observation
- ☐ Focus groups
- ☑ Questionnaires/surveys
- ☐ Action research
- ☐ Personal documents
- ☐ Medical records
- ☑ Literature review
- ☐ Systematic review
- ☐ Secondary data analysis
- ☐ Advisory/consultation/collaborative groups
- ☐ Other

Please describe briefly the population that you will study

The population includes: Pilots, Engineers, and regulators across the world.

How will you evaluate (validate/verify/analyse) your data?

- ☑ I will collect the data and then determine whether there are significant groupings or trends present (information-theoretic models)
- ☑ I will test a hypothesis
- ☑ Other

If other, please specify

Using special programs such as SPSS

Please assign your research project to one of the University Themes

Transport Systems

Please click on 'Next' in left hand actions bar to move forward to Part 4

Part 4: Specialist Studies

This section relates to research around health and defence topics. For most applications the questions will not be applicable.

Have you ensured that your study complies with The Human Tissue Act 2004 and its nine codes of practice?

- ○ Yes
- ○ No
- ◉ Not applicable

Are you conducting research involving human participants undertaken, funded or sponsored by the Ministry of Defence?

- ○ Yes
- ◉ No

Is the research taking place in or through the National Health Service (NHS)?

- ○ Yes
- ◉ No

Please click on 'Next' in left hand actions bar to move forward to Part 5

Part 5: Supporting Documents

You are encouraged to upload a research protocol if this is common practice in your area of study. In addition, please upload any supporting documents you may have that will help reviewers understand your research design such as questionnaires, interview schedules, participant information sheets, consent forms, case for support etc. (dependent on study)

Type	Name	File Name	Date	Version	Size
Supporting Document	Survey.version.5	Survey.version.5.docx			40.6 KB

Please click on 'Next' in left hand actions bar to move forward to Part 6

Part 6: Declarations and Signatures

Researcher Declaration

- The completed form is accurate to the best of my knowledge and belief.
- I undertake to abide by Cranfield University's Ethics Policy in undertaking this project.
- I understand that ethical approval for projects, and that the seeking and obtaining of all other necessary approvals and permissions prior to starting the project is my responsibility.
- I understand that I must not begin the research until I have received approval from the Cranfield University Research Ethics System (CURES).
- I understand that any significant changes that I would like to make to this project after receiving approval from CURES, will require a new application to be submitted.

Researcher Signature

Supervisor Declaration

- I confirm that I have read and fully support this application and will be acting as the supervisor of the lead researcher (student) for this project.
- I have checked that the application has been completed correctly and is of good quality.
- In my opinion, the proposal is viable.
- I understand that the lead researcher I am supervising must not begin the research until they have received approval from the Cranfield University Research Ethics System (CURES).

Lead Supervisor Signature

Students must obtain a signature from their supervisor prior to submission

Once both signatures are in place, you can submit the application using the action button in the left hand bar

IT IS VERY IMPORTANT THAT YOU PRESS SUBMIT AS YOUR FINAL ACTION

IF YOU DO NOT, YOUR APPLICATION WILL NOT BE PROCESSED

7.3 Appendix C: Quantitative Data Analyses

7.3.1 Characteristics of the sample

Table 48 Responders organisation

Aviation Organization	Frequency	Percent
Full-service carrier	33	% 38.4
Regional carrier	38	%44.2
Regulator	4	%4.7
Other, please specify	11	%12.8
Total	86	%100.0

Table 49 Responders type of work

Type of work	Frequency	Percent
Engineering	2	%2.3
Flight Operations (pilot)	71	%82.6
Flight Operations (cabin crew)	7	%8.1
Regulator	2	%2.3
Investigator	4	%4.7
Total	86	%100.0

Table 50 Responders years of experience

Years of experience	Frequency	Percent
0-5 Years	42	%48.8
6-10 Years	15	%17.4
11 Years - more	29	%33.7
Total	86	%100.0

Table 51 Responders base of operations

Base location	Frequency	Percent
The Middle East & North Africa	46	%53.5
Central & South African countries	5	%5.8
Australia, New Zealand, & Oceania	1	%1.2
The Indian Sub-contentint	1	%1.2
Europe	5	%5.8
North America	28	%32.6
Total	86	%100.0

Table 52 Responders work abroad

Have you ever worked outside of your home country?	Frequency	Percent
Yes, please explain	36	%41.9
No	50	%58.1
Total	86	%100.0

Table 53 Responders other aviation roles

Have you ever worked in other roles within the aviation industry?	Frequency	Percent
Yes, please specify	40	%46.5
No	46	%53.5
Total	86	%100.0

Table 54 Punishment for committing errors

Do you think aviation professionals should be punished for committing unintentional errors?	Frequency	Percent
Yes, please explain why	12	14.0
No, please explain why	40	46.5
Sometimes, please explain why	34	39.5
Total	86	100.0

Table 55 Punishment for committing violations

Do you think aviation professionals should be punished for committing violations?	Frequency	Percent
Yes, please explain why	38	44.2
No, please explain why	7	8.1
Sometimes, please explain why	41	47.7
Total	86	100.0

7.3.2 Investigative Questions

1. What are the opinions of the sample regarding personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation?
2. Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (location of operations base)?
3. Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (type of profession)?
4. Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (years of experience)?

   To answer these questions four questions were derived with tables containing means, standard deviations and ranking for each statement and its 5 point response-intensity scale as follows (5 - 4.21) strongly agree, (4.2 – 3.41) agree, (3.4 – 2.61) neither agree nor disagree “neutral”, (2.6 – 1.81) disagree, (1.8 – 1.0) strongly disagree.

   A- What is the representation of opinions of the sample regarding **personal power-distance**, organisational power-distance, blame and punishment, training, and criminalisation?

5. Mean 1 representing opinions of the sample regarding personal power-distance.

   B- What are the opinions regarding personal power-distance, **organisational power-distance**, blame and punishment, training, and criminalisation?

Mean 2 is the opinions of the sample regarding organisational power-distance

C- What are the opinions regarding personal power-distance, organisational power-distance, **blame and punishment, training, and criminalisation?**

6. Mean 3 is the opinions of the sample regarding blame, punishment, and criminalisation.

D- What are the opinions regarding personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation?

7. Mean 6 is a representation of opinions of the sample regarding training.

Question 2- Are there differences that are statistically significant between the opinions of the sample with respect to **personal power-distance,** organisational power-distance, blame and punishment, training, and criminalisation due to the variable (location of operations base)?

To answer this question the following Hypotheses were invented to address each factor.

To address the first factor (personal power-distance) 2 two hypotheses are stated

There are statistically significant differences between the opinions of the sample with respect to personal power-distance, and criminalisation due to the variable (location of operations base).

The null Hypothesis H_o: There are no statistically significant differences between the opinions of the sample with respect to **personal power-distance,** and criminalisation due to the variable (location of operations base).

Table 56 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.391	5	.878	4.877	.001
Within Groups	14.405	80	.180		
Total	18.796	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig<0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

There are statistically significant differences between the opinions across the sample with respect to **personal power-distance**, and criminalisation due to the variable (location of operations base).

Question 2 A

The null hypothesis H_o: There are differences with statistical significance between the opinions across the sample with respect to **organisational power-distance,** due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions across the sample with respect to **organisational power-distance**, due to the variable (location of operations base).

Table 57 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.236	5	.647	2.149	.068
Within Groups	24.096	80	.301		
Total	27.332	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that

exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

There are no differences that are statistically significant between the opinions across the sample with respect to **organisational power-distance**, due to the variable (location of operations base).

Question 2B-

The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to **blame, punishment, and criminalisation**, due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **blame, punishment, and criminalisation,** due to the variable (location of operations base).

Table 58 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.582	5	.316	.614	.689
Within Groups	41.213	80	.515		
Total	42.795	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

There are no differences that are statistically significant between the opinions across the sample with respect to **blame, punishment, and criminalisation**, due to the variable (location of operations base).

Question 2C-

The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame, and punishment, due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame, and punishment, due to the variable (location of operations base).

Table 59 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.825	5	.165	.255	.936
Within Groups	51.724	80	.647		
Total	52.549	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2D-

The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to criminalisation, due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to criminalisation, due to the variable (location of operations base).

Table 60 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.715	5	.543	1.258	.290
Within Groups	34.532	80	.432		
Total	37.247	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2 E-

The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to criminalisation and training, due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to criminalisation and training, due to the variable (location of operations base).

Table 61 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.334	5	.267	.512	.766
Within Groups	41.701	80	.521		
Total	43.035	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2 F-

The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame and punishment for committing errors, due to the variable (location of operations base).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 62. Chi- square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.858[a]	10	.739
Likelihood Ratio	7.685	10	.660
Linear-by-Linear Association	.230	1	.632
N of Valid Cases	86		

13 cells (72.2%) have expected count less than 5. The minimum expected count is .14.

Table 25

A Chi- square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 2 G-

The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (location of operations base).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame and punishment for committing violations, due to the variable (location of operations base).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 63. Chi- square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.679[a]	10	.912
Likelihood Ratio	6.167	10	.801
Linear-by-Linear Association	.453	1	.501
N of Valid Cases	86		

b. 14 cells (77.8%) have expected count less than 5. The minimum expected count is .08.

Table 26

A Chi- square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

Question 3

Are there correlations and or statistical differences between the opinions of the sample with respect to **personal power-distance**, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (profession)?

3 A- To answer this question two hypothises were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **personal power-distance,** due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **personal power-distance**, due to the variable (profession).

Table 64. ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.744	4	1.436	8.912	.000
Within Groups	13.052	81	.161		
Total	18.796	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig<0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

There are statistically significant differences between the opinions of the sample with respect to personal power-distance due to the variable (profession).

To investigate the statistical differences a Shefe test was performed to highlight the following

There is a statistical difference between the means of pilots and cabin crew which is highlighted by a significance level .05 or less. This suggests the need for further investigation of this correlation.

Table 65. Shefe test

	Engineering	sig	Flight Operations (pilot)	sig	Flight Operations (cabin crew)	sig	Regulator	sig	Investigator	sig
Engineering			.89336	.056	.23469	.970	.57143	.731	.17857	.992
Flight Operations (pilot)	-.89336-	.056			-.65867-*	.003	-.32193-	.869	-.71479-*	.023
Flight Operations (cabin crew)	-.23469-	.970	.65867*	.003			.33673	.894	-.05612-	1.000
Regulator	-.57143-	.731	.32193	.869	-.33673-	.894			-.39286-	.864
Investigator	-.17857-	.992	.71479*	.023	.05612	1.000	.39286	.864		

*. The mean difference is significant at the 0.05 level.

3 B- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, **organisational power-distance,** blame and punishment, training, and criminalisation due to the variable (profession)?

To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **organisational power-distance,** due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **organisational power-distance,** due to the variable (profession).

Table 66. ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.287	4	.572	1.849	.128
Within Groups	25.045	81	.309		
Total	27.332	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

There are no statistically significant differences between the opinions of the sample with respect to **organisational power-distance** due to the variable (profession).

Question 3 C –

- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, **blame and punishment**, training, and **criminalisation** due to the variable (profession)?

To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **blame, punishment, and criminalisation** due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **blame, punishment, and criminalisation,** due to the variable (profession).

Table 67 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.071	4	.768	2.223	.074
Within Groups	27.982	81	.345		
Total	31.054	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3 D- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, **blame and punishment**, training, and criminalisation due to the variable (profession)?

To answer this question, two hypotheses were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **blame, punishment**, due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **blame, punishment,** due to the variable (profession).

Table 68. ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.926	4	1.482	2.574	.044
Within Groups	46.623	81	.576		
Total	52.549	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig<0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

To further investigate this correlation and those statistical differences a Shefe test was conducted to highlight those correlations as follows

Table 69. Shefe test

	Engineering	sig	Flight OPS (pilot)	sig	Flight OPS (cabin crew)	sig	Regulator	sig	Investigator	sig
Engineering			.37887	.975	-.12857-	1.000	-.20000-	.999	-.65000-	.912
Flight Operations (pilot)	-.37887-	.975			-.50744-	.586	-.57887-	.888	-1.02887-	.149
Flight Operations (cabin crew)	.12857	1.000	.50744	.586			-.07143	1.000	-.52143-	.877
Regulator	.20000	.999	.57887	.888	.07143	1.000	-		-.45000-	.976
Investigator	.65000	.912	1.02887	.149	.52143	.877	.45000	.976		

*. The mean difference is significant at the 0.05 level.

In table 73 above there the Shefe test was unable to highlight the specific clear correlations and statistically significant differences, for the specialisation on its own. However there are statistically significant differences in general, due to the specify profession.

3 E- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-

distance, blame and punishment, training, and **criminalisation** due to the variable (profession)?

To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **criminalisation,** due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **criminalisation**, due to the variable (profession).

Table 70. ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.115	4	.529	1.219	.309
Within Groups	35.132	81	.434		
Total	37.247	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3 F- Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, **training, and criminalisation** due to the variable (profession)?

To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **training and criminalisation,** due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **training and criminalisation,** due to the variable (profession).

Table 71. ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.302	4	.826	1.683	.162
Within Groups	39.733	81	.491		
Total	43.035	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3 G- The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame and punishment for committing **errors,** due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame and punishment for committing **errors**, due to the variable (profession).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 72. Chi- square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.879[a]	8	.157
Likelihood Ratio	13.857	8	.086
Linear-by-Linear Association	4.435	1	.035
N of Valid Cases	86		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .28.

A Chi- square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

3 H – The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame and punishment for committing **violations**, due to the variable (profession).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame and punishment for committing **violations**, due to the variable (profession).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 73. Chi- square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.610[a]	8	.293
Likelihood Ratio	9.860	8	.275
Linear-by-Linear Association	.636	1	.425
N of Valid Cases	86		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .16.

A Chi- square test was performed to test those hypotheses, where the above table illustrates that there is a difference with statistical significance (sig. < 0.05) that exists, which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

Question 4 - Are there correlations and or statistical differences between the opinions of the sample with respect to personal power-distance, organisational power-distance, blame and punishment, training, and criminalisation due to the variable (**years of experience**)?

4 A- To answer this question two hypotheses were tested

The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **personal power-distance**, due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **personal power-distance**, due to the variable (years of experience).

Table 74 ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.969	2	.985	4.856	.010
Within Groups	16.827	83	.203		
Total	18.796	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig<0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

To further investigate this correlation and those statistical differences a Shefe test was conducted to highlight those correlations as follows

Table 75. Shefe test

	0-5 Years	sig	6-10 Years	sig	11 Years - more	sig
0-5 Years			-.09252-	.792	.28794*	.034
6-10 Years	.09252	.792			.38046*	.034
11 Years - more	-.28794-*	.034	-.38046-*	.034		

*. The mean difference is significant at the 0.05 level.

The statistical difference was observed to be significant between years of experience (0-5 years) and (11 years or more), therefore the data suggests that a correlation exists between personal power-distance and years of experience.

4 B – The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **organisational power-distance**, due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **organisational power-distance,** due to the variable (years of experience).

Table 76 ANOVA test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.419	2	1.209	4.029	.021
Within Groups	24.914	83	.300		
Total	27.332	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is a difference that exists with statistical significance (sig<0.05), which means that the null hypothesis is rejected and the alternative hypothesis is accepted.

To further investigate this correlation and those statistical differences a Shefe test was conducted to highlight those correlations as follows

Table 77 Shefe test

	0-5 Years	sig	6-10 Years	sig	11 Years - more	sig
0-5 Years			.04405	.965	.36474*	.026
6-10 Years	-.04405-	.965			.32069	.190
11 Years - more	-.36474-*	.026	-.32069	.190		

*. The mean difference is significant at the 0.05 level.

The statistical difference was observed to be significant between years of experience (0-5 years) and (11 years or more), therefore the data suggests that a correlation exists between organisational power-distance and years of experience.

4 C – The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **blame, punishment, and criminalisation,** due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **blame, punishment, and criminalisation**, due to the variable (years of experience).

Table 78 ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.944	2	.472	1.301	.278
Within Groups	30.110	83	.363		
Total	31.054	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 D – The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **blame, and punishment,** due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **blame, and punishment,** due to the variable (years of experience).

Table 79 ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.266	2	.133	.211	.810
Within Groups	52.283	83	.630		
Total	52.549	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 E – The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **criminalisation,** due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **criminalisation**, due to the variable (years of experience).

Table 80 ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.036	2	1.018	2.400	.097
Within Groups	35.211	83	.424		
Total	37.247	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 F- The null hypothesis H_o: There are no differences with statistical significance between the opinions of the sample with respect to **training and criminalisation,** due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to **training and criminalisation,** due to the variable (years of experience).

Table 81 ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.297	2	.148	.288	.750
Within Groups	42.738	83	.515		
Total	43.035	85			

An ANOVA test was performed to test those hypotheses, where the above table illustrates that there is no difference that exists with statistical significance (sig>0.05), which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

4 G- The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame and punishment for committing **errors**, due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame and punishment for committing **errors**, due to the variable (years of experience).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 82 Chi-square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.681[a]	4	.794
Likelihood Ratio	1.697	4	.791
Linear-by-Linear Association	.666	1	.414
N of Valid Cases	86		

b. 2 cells (22.2%) have expected count less than 5. The minimum expected count is 2.09.

4 H- The null hypothesis H_o: There are differences with statistical significance between the opinions of the sample with respect to blame and punishment for committing **violations**, due to the variable (years of experience).

The alternative hypothesis: There are statistically significant differences between the opinions of the sample with respect to blame and punishment for committing **violations**, due to the variable (years of experience).

To test these hypotheses a Chi-Square test was suitable and the results were as follows

Table 83 Chi- square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.769[a]	4	.067
Likelihood Ratio	8.967	4	.062
Linear-by-Linear Association	5.368	1	.021
N of Valid Cases	86		

a. 3 cells (33.3%) have expected count less than 5. The minimum expected count is 1.22.

A Chi- square test was performed to test those hypotheses, where the above table illustrates that there is no difference with statistical significance (sig. >0.05) that exists, which means that the null hypothesis is accepted and the alternative hypothesis is rejected.

7.3.3 Description of variables and means

7.3.3.1 Main factors

Main factors were derived to divide the collected data into, and they are as follows;

1- Personal power-distance
2- Organisational power-distance
3- Fear of prosecution by court
4- Fear of punishment by company

7.3.3.2 Means:

A- Mean 1 Personal Power Distance

```
Personal-Power distance.  (Mean1)

GET

  FILE='C:\Users\the best\Desktop\ \Final survey - distribution_June
8, 2018_05.23.sav'.

DATASET NAME DataSet1 WINDOW=FRONT.

COMPUTE
mean1=mean(Q12_1,Q15_15,Q15_16,Q16_7,Q16_8,Q16_9,Q16_10,Q16_12,Q18_6,Q
18_4,Q18_7,Q18_8,Q20_1,Q16_11).

EXECUTE.

DESCRIPTIVES VARIABLES=Q12_1 Q15_15 Q15_16 Q16_7 Q16_8 Q16_9 Q16_10
Q16_11 Q16_12 Q18_6 Q18_4 Q18_7 Q18_8 Q20_1 mean1

  /STATISTICS=MEAN STDDEV.
```

Personal Power Distance; with references in the Qualtrics report

Related to the following statements

1- (12.1) intentionally deviating from Standard Operating Procedures (SOPs) should not be tolerated, for example if a crew elected not to read a checklist.

2- (15.15) Knowing that I might be prosecuted if deviating from procedures caused an accident. I might still deviate from SOPs, if I was instructed to do so by my supervisors.

3- (15.16) I am likely to follow SOPs, even if not supported by my supervisors.

4- (16.7) I expect to be consulted on matters that affect the performance of my duties.

5- (16.8) Senior staff deserve extra benefits and privileges.

6- (16.9) Captains or managers who encourage suggestions from crew members are weak leaders.

7- (16.10) Junior Flight crew members should not question the captain's or senior crew member's decisions.

8- (16.12) in abnormal situations, I rely on my superiors to tell me what to do.

9- (18.6) the captain should take physical control and fly the aircraft in emergency and non-standard situations. In other words, superiors or senior employees should take charge in non-standard or emergency situations.

10- (18.4) Successful flight deck management is primarily a function of the captain's flying proficiency.

11- (18.7) Crew members should not question the decisions or actions of the captain except when they threaten the safety of the flight.

12- (18.8) there are no circumstances (except total incapacitation) where the first officer should take command from the captain.

13- (20.1) **Style 1**. Usually makes his/her decisions promptly and communicates them to his/her subordinates clearly and firmly. Expects them to carry out the decisions loyally and without raising difficulties. (If chosen indicates High personal-power distance).

14- (16.11) Crew members share responsibility for prioritizing activities in high workload situations.

B- Mean 2 Organisational power-distance

```
Organisational power-distance (Mean 2)


COMPUTE mean2=mean(Q15_13,Q15_14,Q17,Q21_1).

EXECUTE.

DESCRIPTIVES VARIABLES=Q15_14 Q15_13 Q17 mean2 add Q21

  /STATISTICS=MEAN STDDEV.
```

Related to the following statements

1- (15.13) Questioning and/or correcting actions or opinions of senior staff or managers is NOT normal within my organization.
2- (15.14) Questioning and/or correcting actions or opinions of senior staff or managers is normal within my organization.
3- (17) How frequently, in your work environment, are subordinates afraid to express disagreement with their superiors?
4- (21) In your organization, which one of the above styles do you find yourself most often working under?

C- Mean 3 Blame, punishment, and criminalisation

```
  FILE='C:\Users\the best\Desktop\ \Final survey - distribution_June
8, 2018_05.23.sav'.

DATASET NAME DataSet1 WINDOW=FRONT.

COMPUTE
mean3=mean(Q12_2,Q12_4,Q12_6,Q12_7,Q12_8,Q12_9,Q13_1,Q13_2,Q13_3,Q13_4
,Q13_5).

EXECUTE.

DESCRIPTIVES VARIABLES=Q12_2 Q12_4 Q12_6 Q12_7 Q12_8 Q12_9 Q13_1 Q13_2
Q13_3 Q13_4 Q13_5

  /STATISTICS=MEAN STDDEV.
```

Related to the following statements

1- (12.2) The fear of being punished by the company makes me follow SOPs.
2- (12.4) The fear of being punished by aviation authorities makes me follow SOPs.
3- (12.6) The fear of being prosecuted by a court influences my performance on a normal flight.
4- (12.7) The possibility of being reported, e.g. for non-adherence to SOPs, has a POSITIVE influence on my performance. (For example, the thought of being reported for not complying with ATC instructions, makes me perform better.)
5- (12.8) The possibility of being reported, e.g. for non-adherence to SOPs, has a NEGATIVE influence on my performance. (For example, the thought of being reported for not complying with ATC instructions, makes me perform worse.)
6- (12.9) My fear of being reported or prosecuted for deviations from SOPs has increased in the past five years.
7- (13.1) Some countries prosecute aviation professionals for “not doing the job right”.
8- (13.2) The fear of being prosecuted is higher in some countries than others.
9- (13.3) In the course of my daily routine, the fear of prosecution may interfere with the way I perform.
10- (13.4) If there was continuous management presence in the workplace, the way I perform tasks will be different.
11- (13.5) Deviation from Standard Operating Procedures (SOPs) is necessary sometimes in order to expedite routine tasks.

D- Mean 4 Blame and punishment by the company

```
COMPUTE mean4=mean(Q12_2,Q12_4,Q12_9,Q13_4,Q13_5).

EXECUTE.

ONEWAY mean4 BY Q5

  /MISSING ANALYSIS

     /POSTHOC=SCHEFFE ALPHA(0.05).
```

Related to the following statements

1- (12.2) The fear of being punished by the company makes me follow SOPs.

2- (12.4) The fear of being punished by aviation authorities makes me follow SOPs.
3- (12.9) My fear of being reported or prosecuted for deviations from SOPs has increased in the past five years.
4- (13.4) If there was continuous management presence in the workplace, the way I perform tasks will be different.
5- (13.5) Deviation from Standard Operating Procedures (SOPs) is necessary sometimes in order to expedite routine tasks.

E- Mean 5 Fear of Criminalisation by a court

```
COMPUTE mean5=mean(Q12_6,Q13_1,Q13_2,Q13_3,Q13_4,Q15_15).

EXECUTE.

ONEWAY mean5 BY Q5

  /MISSING ANALYSIS

  /POSTHOC=SCHEFFE ALPHA(0.05).
```

Related to the following statements

1- (12.6) the fear of being prosecuted by a court influences my performance on a normal flight.
2- (13.1) Some countries prosecute aviation professionals for “not doing the job right”.
3- (13.2) The fear of being prosecuted is higher in some countries than others.
4- (13.3) In the course of my daily routine, the fear of prosecution may interfere with the way I perform.
12- (13.4) (13.4) If there was continuous management presence in the workplace, the way I perform tasks will be different. DUPLICATED IN” BALME PUNISHMENT”
5- (15.15) Knowing that I might be prosecuted if deviating from procedures caused an accident. I might still deviate from SOPs, if I was instructed to do so by my supervisors.

F- Mean 6 Training and criminalisation

```
FILE='C:\Users\the best\Desktop\Final survey - distribution_June 8,
2018_05.23.sav'.

DATASET NAME DataSet1 WINDOW=FRONT.

COMPUTE mean6=mean(Q14_7,Q14_9).

EXECUTE.
```

```
DESCRIPTIVES VARIABLES=Q14_7 Q14_9 mean6
  /STATISTICS=MEAN STDDEV.
```

Related to the following statements

1- (14.7) I like to train my new colleagues, even if it is not my duty to do so.
2- (14.9) Training will be negatively affected if human error was prosecuted.