Organisational Risk Resilience

Risk Assessments' Contribution to Organisational Precursor Resilience

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ABSTRACT

The resilient organisation has recently become a focus for many safety risk professionals, as it offers the attractive idea of the attainable strategy to prepare for and deal with various types of adversity. Even though the safety science literature has been preoccupied with the normative study of the resilient organisation, a lack of empirical knowledge seems to exist of how this can be attained (Boin & Van Eeten, 2013).

The purpose of this research was to relate certain organisational characteristics and processes to organisational resilience. However, the notion of organisational resilience is intricate, as it is not a phenomenon which can be directly observed. To overcome this, this research has sought to establish a correlation between the anticipatory principles from collective mindfulness, with the notion of organisational resilience pertaining to the preventative activities prior to a disruption; labelled precursor resilience. By expositing the characteristics related to precursor resilience from the literature, this research established a conjectural link to the anticipatory principles as one measure of precursor resilient performance.

This research has thus operationalised the anticipatory principles to investigate in what way the airline, Thomas Cook Airlines Scandinavia, is collective mindful in its risk assessment activities in relation to a management of change. The generated empirical knowledge has been collected based on ten interviews within this company, and then analysed to uncover organisational characteristics and processes that can be related to precursor resilience.

Although the link between precursor resilience and the anticipatory principles is merely conjectural, this research found that several characteristics and processes of the risk assessment activities in relation to a management of change could be related to precursor resilience. However, many of the characteristics and processes pertaining to precursor resilience from these types or risk assessments should not be seen independently, but in a much larger organisational context. It appears from this research, that for an organisation to maintain and operate within a precursor resilient zone, requires an organisational capacity to ensure upholding the organisational activities revolving around the risk assessment in relation to a management of change.

ACRONYMS

ALARP	As Low As Reasonably Practicable
AM	Accountable Manager
AMC	Acceptable Means of Compliance
APU	Auxiliary Power Unit
ARMS	Aviation Risk Management Solutions
CPH	Copenhagen Airport
DTCA	Danish Transport and Construction Agency
EASA	European Aviation Safety Agency
EASp	European Aviation Safety Plan
ECAST	European Commercial Aviation Safety Team
EU	European Union
GM	Guidance Material
HRO	High Reliability Organisation
HRT	High Reliability Theory
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IT	Information Technology
JAA	Joint Aviation Authorities
MNPS	Minimum Navigation Performance Specification
MoC	Management of Change
MPADS	Man-Portable Air-Defense System
NP	Nominated Person
ORA	Operational Risk Assessment
ORM	Operational Risk Management
Part-ORO	Organisation Requirements for Air Operations
PED	Personal Electronic Device
SARP	Standards and Recommended Practice
SAS	Scandinavia Airlines
SCAG	Safety & Compliance Action Group
SCRB	Safety & Compliance Review Board
SSP	State Safety Programme
SMM	Safety Management Manual
SMS	Safety Management System
SRA	Safety Risk Assessment
SRM	Safety Risk Management
TCAB	Thomas Cook Airlines Belgium
TCAS	Thomas Cook Airlines Scandinavia
TCG	Thomas Cook Group plc
TCGA	Thomas Cook Group Airlines
TCUK	Thomas Cook Airlines UK
UN	United Nations
WCO	Worst Credible Outcome

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INTRODUCTION

"There is no set of administrative arrangements which will guarantee safety."

– Nick Pidgeon in (Turner & Pidgeon, 1997, p. 189)

1. INTRODUCTION

"What distinguishes reliability-enhancing organisations is not their absolute error or accident rate, but their effective management of innately risky technologies through organisational control of both hazard and probability (…)" (Rochlin, 1993, p. 17).

Safety within the aviation industry has always been considered the standard to which to aspire. The number of airline departures has risen in the past few years, and it is estimated to rise even further in the future. Even though the accident rate for global aviation is declining, every airline still struggles to deal with safety issues. International Air Transport Association (IATA) director general Tony Tyler said that *"[in] 2013 there were some 36.4 million flights and 16 fatal accidents. If you were flying on a jet aircraft, your chances of being involved in a major accident were one in 2.4 million. And among the three billion passengers that flew there were 210 fatalities. There is no safer way to get from A to B than by plane. But accidents do happen"* (IATA, 2014). A failure of foresight, or the lack of a comprehensive risk management and crisis response, can quickly put an airline out of business. Thus, it is important for certain high-risk organisations, such as airlines, to take precautionary measures against unwanted outcomes and to think and act proactively towards risks. The civil aviation industry is well known for its persistent work in safety management and the never-ending inquiry into even small inconsistencies, which is managed through a detailed regulatory framework, common worldwide agreements and extensive procedures. One such rather new initiative put forward by both the International Civil Aviation Organisation and the European Aviation Safety Agency is a risk assessment in relation to a management of change (MoC). An MoC has been defined as a formal process for systematic and proactive identification of hazards and of appropriate mitigation strategies and measures, to be applied to all changes concerning the safety of services provided by an airline due to, for example, expansion, new flight routes and changes to existing systems, equipment or services, as these changes introduce new or altered hazards (ICAO, 2013a; Skybrary, 2014c). The question which remains is whether such an initiative contributes to organisational resilience.

The safety science literature has recently been preoccupied with the normative study of the resilient organisation (Boin & Van Eeten, 2013; Comfort, Boin, & Demchak, 2014; Hollnagel, Woods, & Leveson, 2006). Although the elements that contribute to a resilient organisation have been broadly discussed, empirical research on the resilient organisation is quite rare (Boin & Van Eeten, 2013). However, resilience is not without antecedents, as it is widely known within diverse academic fields, including psychology, sociology, ecology, public administration and political science. Definitions of resilience can thus be found on micro, meso and macro levels, pertaining to different levels of analysis (Boin & Van Eeten, 2013). This research is placed on a meso level as it is interested in organisational activities. However, several challenges exist with

organisational resilience; one challenge seems to spin around a proactive and reactive pole (Comfort et al., 2014). Organisational resilience can therefore pertain to the preventive activities prior to a disruption or, in the wake of a crisis, to recovery activities (Boin & Van Eeten, 2013; Comfort et al., 2014; Macrae, 2014). If organisational resilience relates to preventive activities prior to a disruption, it has been labelled 'precursor resilience' and defined as the "*ability to accommodate change without catastrophic failure (…)*" (Wise, Hopkin, & Stager, 1993, p. 93). If organisational resilience is in response to a crisis, it has been labelled 'recovery resilience' and defined as "*the ability to respond to singular or unique events*" (Kendra & Wachtendorf, 2003, p. 42). Both types of resilience are very much needed in highly reliable organisations (HROs) to anticipate and contain adversities. However, some organisations within the aviation industry, the nuclear power industry and others must place themselves within a precursor resilient zone, as a single disruption can have a disastrous outcome which reaches beyond the organisation itself. Such disruptions does not need to involve only technological system accidents (Perrow, 2011), but rather they can involve deficiencies in the organisational activities to ensure safety (Hopkins, 2001; LaPorte, 1996; LaPorte & Consolini, 1991; Turner & Pidgeon, 1997).

1.1. BACKGROUND FOR CHOICE OF TOPIC

Organisations has long desired for resilience, which they have invested tremendous time, money and effort to achieve, not without reason because "*the idea of resilience offers the promise of an intuitively plausible, attractive and seemingly attainable strategy to prepare for and deal with various types of adversity*" (Boin & Van Eeten, 2013, p. 430). However, while the literature has been preoccupied with the normative and prescriptive ideas of the resilient organisation, is it still unclear how these skills of resiliency can be built into an organisation (Boin & Van Eeten, 2013). There is an absence of empirical knowledge on organisational resilience, or as Boin and Van Eeten (2013, p. 432) point out, "*the dearth of empirical data makes it hard if not impossible to relate with any type of certainty organisational characteristics and processes to resilient performance*". The challenge with organisational resilience therefore is to conform to an ideology with almost no evident links to certain organisational characteristics or processes. This lack of empirical knowledge poses a problem in the academic literature and Boin and Van Eeten (2013, p. 443) highlight "*(…) that we should be careful to prescribe resilience before we develop a stronger grasp on the relation between organizational characteristics, processes and outcomes. Much more research is needed before prescriptions for resilience can be administered*".

With this study, the researcher hopes to contribute to bringing forward much needed empirical knowledge of organisational characteristics which can be attributed to organisational resilience. If one needs to link such organisational characteristics and processes pertaining to resilient performance, it is necessary to study the

tacit knowledge and processes of a well-established, presumably highly reliable organisation to generate such empirical knowledge. Thomas Cook Airlines Scandinavia (TCAS) is therefore chosen for this research as it must adhere to persistent work with risk management. This enables the researcher to investigate TCAS and its adopted risk assessment activities in relation to an MoC. The researcher is therefore in a position to explore the tacit knowledge of the processes, the procedures and any challenges or strengths embedded at TCAS and to explore whether any of those organisational characteristics and processes contribute to characteristics of organisational resilience. However, the challenge with resilience is that it is not a measurable or quantifiable phenomenon which can be directly observed in any organisation. To overcome this obstacle, this research must therefore look elsewhere to operationalise organisational precursor resilience to explore, investigate and possibly generate knowledge of characteristics resembling organisational precursor resilience.

1.2. RESEARCH PURPOSE

Inspired by the above introductory quotation, HROs should not be characterised by an absence of risk or accidents, but rather by a focus on the organisation's persistent processes which it uses to manage its organisational activities with respect to risks. Although the utopian dream for an organisation that eliminates all risk is impossible for many reasons, the desire to become and maintain a resilient organisation lives on. This research is thus interested in the organisational approaches and activities in an airline which create and foster organisational precursor resilience. The purpose of this research is therefore twofold.

First, by employing TCAS as a case for this research, the researcher can assess embedded deficiencies or strengths inherited in its adopted risk assessment process in relation to an MoC. Second, and more importantly, the researcher can explore how such activities contribute to organisational precursor resilience. Analysing characteristics of organisational precursor resilience requires an understanding of what causes organisational accidents and the drift towards complacency (Reason, 1997; Weick, Sutcliffe, & Obstfeld, 1999). These high-risk organisations must position themselves within a precursor resilient zone and fight against the current of complacency, which, according to Turner and Pidgeon (1997), stems from factors such as perceptual rigidities, information ambiguities, disregard of rules and instructions, overconfidence and organisational arrogance. These factors, in conjunction, make for the incubation of disaster, known as the Man-Made Disaster theory. Therefore, adversity does not necessarily occur due to a lack of risk management; rather, the deficiencies in the organisation's institutionalised practices cause a disruption (Turner & Pidgeon, 1997).

The resilient organisation in social and safety science is still an emergent and developing concept with many diverse meanings and interpretations. This research will account for the notion of organisational precursor

resilience and draw upon the newly termed risk resilience concept (Macrae, 2014) to broaden the idea of precursor resilience. Risk resilience can be seen as an important link to organisational resilience and a contribution to the theoretical framework because it differentiates between a material and cultural view on disruptions (Macrae, 2014). Risk resilience concerns an organisation's ability to protect its operations from potential breakdowns and the (in)effectiveness of its practices that produce barriers and defences rather than actual or predicted outcomes (Macrae, 2014). Turning the knowledge of organisational deficiencies into an organisational capacity to protect organisational activities creates risk resilience and thus builds on the knowledge of Turner and Pidgeon (1997) and complements the Man-Made Disaster theory. However, as precursor resilience encompasses a broad concept, one must, as previously mentioned, operationalise it to be able to draw parallels between the concept and organisational characteristics.

Many scholars have studied the organisational prerequisites which should give organisations the ability to maintain safe performance even when these organisations constitutes of complex systems and tightly technological couplings, operating in a vicious, dangerous and fast-paced environment. One such organisational prerequisite is collective mindfulness (Weick et al., 1999). Collective mindfulness captures the characteristics of HROs, while acknowledging the impossible goal of error-free operations. When organisations display characteristics of the minimum five identified social processes that represent collective mindfulness, they should be able to anticipate and contain adversities as they arise. Therefore, collective mindfulness helps in avoiding fixation failures, as the stable processes in collective mindfulness allow for the detection of anomalies while the variable patterns of activity adapt to events which require revision (Weick et al., 1999). As this research is preoccupied with precursor resilience, only the first three principles of collective mindfulness will be used, as they pertain to the anticipatory skills of an organisation.

The importance of broadening the risk perspective with collective mindfulness has been established by Aven and Krohn (2014). Because assessments of risk can be completely ignored or judged negligible based on the (un)likelihood of the risk, must risk activities within an organisation give weight to a broadened risk perspective because the traditional probability-based perspective on risk can be seen as "*(…) too narrow, ignoring and concealing important aspects of risk and uncertainties*" (Aven & Krohn, 2014, p. 1). While ignoring aspects of risk and uncertainties can pertain to the more mechanical probability-based perspective and risk acceptance criteria, it can also conceal risk and uncertainties that pertain to the social negotiation of risk (Vaughan, 1996). Vaughan (1996) conceptualises normalisation of deviance based on her analysis of the Challenger launch decision. She refers to the idea that over time organisations increase the acceptable risk criteria due to a social negotiation of risk. These two theoretical contributions will likewise be included

in the theoretical framework to broaden the analysis of the risk assessment activities related to an MoC at TCAS.

In summary, the purpose of this research is to develop a broader understanding of the risk assessment activities in relation to an MoC at TCAS and how these assessments contribute to organisational precursor resilience. To achieve this understanding, this research focuses on the three anticipatory principles of collective mindfulness that are related to organisational precursor resilience and investigates the degree to which these characteristics are representative of or relevant for risk assessment in relation to MoCs.

1.3. PROBLEM TO BE ADDRESSED

To research the role of risk assessments in relation to an MoC and organisational precursor resilience and how these risk assessment activities contribute to organisational precursor resilience, the following research question will be addressed:

How does the use of risk assessments in relation to a management of change at Thomas Cook Airlines Scandinavia contribute to organisational precursor resilience?

1.4. SUBSIDIARY QUESTIONS

To answer the above research question, it is necessary to answer two subsidiary questions:

- What is organisational precursor resilience and how does it relate to the anticipatory principles of collective mindfulness?
- In what way is Thomas Cook Airlines Scandinavia collective mindful in its risk assessment activities in relation to a management of change and how is this reflected throughout the organisation?

1.5. DELIMITATIONS

The researcher has chosen to make some delimitations. This subchapter will outline the scope of the research, which allowed the researcher to perform more in-depth research.

Several different risk management activities exist within TCAS. Through an early meeting with TCAS, the focus of this research quickly centered on the company's newly adopted risk assessment approach in relation to an MoC. It is important to highlight that several risk management activities other than risk assessment in relation to an MoC exist and, thus, can be seen as a small part of the company's entire safety risk management setup. When risk assessment is mentioned throughout this research, it is in relation to an MoC unless otherwise explicitly stated.

An understanding emerged of TCAS as an organisation which most likely lies at the superior end of the spectrum when it comes to risk management. This is suggested in the way that the researcher enlisted TCAS for the research. TCAS was contacted through an e-mail address found in a risk management training PowerPoint presentation directed towards the Danish Transport and Construction Agency website. It might have been interesting to study either a conglomerate of an airline or a less established airline to get a more nuanced picture of this research.

Even though TCAS consists of many departments and all contribute to organisational safety, the research was restricted to only four departments. The four chosen departments are the Flight Ops, Ground Ops, Technical and Cabin Service departments. A more in-depth description of these departments will be given in chapter 2.3.

Resilience has many aspects and covers a broad spectrum. It's therefore important to bear in mind that the measure of foresight, or the anticipatory principles of collective mindfulness, is only one element of organisational resilience. Many other aspects of organisational resilience exist but are not relevant for this research and its purpose. This research is not intended to proclaim that an organisation can rely solely on either one of the two types of resilience. Both are necessary within an organisation, and society for that matter, to maintain resilient operations. However, it can be important to decompose systems into smaller parts to gain knowledge by studying a separate phenomenon in depth (Landau, 1969).

1.6. STRUCTURE OF THIS RESEARCH

This chapter has laid the groundwork for the research and its research question, area of interest and purpose. The following section will clarify and account for the structure of this research by introducing the composition. The purpose of this section is to give the reader an overview of the research conducted.

Chapter 1 – Introduction

This current chapter establishes the groundwork for this research.

Chapter 2 – Context

This chapter will provide a contextual understanding of the phenomenon to be studied, including the regulatory framework in relation to risk assessments regarding management of change as well as the airline of interest.

Chapter 3 – Theoretical Framework

This chapter outlines the theoretical framework which gives this research its theoretical foundation. The framework is composed of four elements. First, the choice of theory will be accounted for to explain the connections among the three theoretical contributions of this research. Second, accounting for the Man-Made Disaster gives the reader (and this research) an understanding of the causation of the incubation of disaster. The Man-Made Disaster theory therefore serves as the fundamental basis for why accidents can occur within an organisation and its organisational activities. Third, accounting for organisational resilience and what it represents, the notion of resilience will be investigated and elaborated. Emphasis will be given to organisational precursor resilience in this research. Fourth, where an organisation wants to reach organisational precursor resilience, the anticipatory principles from collective mindfulness will serve as the theoretical framework to achieve this. The chosen theoretical contributions will be used in chapter 6, where the empirical data will be analysed. The last subchapter accounts for the first subsidiary question, where the link between organisational precursor resilience and the anticipatory principles from collective mindfulness is established.

Chapter 4 – Methodology

The methodological considerations that have been taken into account when collecting and processing the empirical data will be outlined in this chapter. This chapter will also clarify the research design and strategy, as well as reflections around validity, reliability and generalisation.

Chapter 5 – Empirical Data

The empirical data chapter has been divided into four parts. The first part presents and highlights the current safety management practice performed by TCAS in relation to an MoC. This process has been derived from an analysis of several documents including TCAS's internal Safety Management Manual (see chapter 4.4.2). The next three subchapters present the empirical findings from ten interviews conducted at TCAS with representatives from five different departments. These three subchapters correspond to each of the three anticipatory principles of collective mindfulness.

Chapter 6 – Analysis

The analytical part of this research is likewise divided into four parts, but takes the opposite approach as found in chapter 3 on the theoretical framework. The first three subchapters will seek to answer the second subsidiary question; the first three subchapters pertain to the three anticipatory principles of collective mindfulness to investigate in what way TCAS display collective mindfulness in its risk assessment activities in

relation to an MoC and how this is reflected throughout the organisation. The fourth and last subchapter sets out to answer the research question by analysing the risk assessment in relation to an MoC at TCAS pertaining to the anticipatory principles of collective mindfulness and how they relate to characteristics of organisational precursor resilience.

Chapter 7 – Conclusion

The research concludes by accentuating the contribution that risk assessment in relation to an MoC makes to organisational precursor resilience.

Context

"We must not become complacent with our own safety records; rather we must employ new methods and programs that can drive down accident rates."

– Jim Hall in (Stolzer, Halford, & Goglia, 2008, p. XIX)

2. CONTEXT

This chapter will briefly provide a contextual understanding of the regulatory framework regarding the risk assessments in relation to a MoC to which TCAS is subjected. An introduction to the airline itself along with its location and composition will also be outlined. The content of this chapter is based on several public documents, regulations and best practices as well as non-public documents received by the airline. The documents used in this research will be explained further in chapter 4.4.2. In this research, the risk assessment process is considered in relation to the whole socio-technological system (Leveson, 2011; Rasmussen & Svedung, 2000), as the constellation and interrelatedness of the regulative framework in a dynamic society constitutes supranational, national and local organisations which influence the design and performance of risk assessments carried out in TCAS.

2.1. REGULATORY FRAMEWORK

International actors in aviation legislation, regulation and standard setting work in complex circumstances. Three main international actors will be highlighted here, as they make up the foundation for the aviation setting in which TCAS operates. TCAS headquarters operates locally within Denmark and, therefore, must abide by national legislation presented by the Danish Transport and Construction Agency. The Danish Transport and Construction Agency adapts and implements regulations put forward by the International Civil Aviation Organisation and European Aviation Safety Agency, as Denmark is a member state of both organisations. As a member state of these two supranational regulators, can national actors, such as the Danish Transport and Construction Agency, only add to the provided regulation and hence make the regulative framework stricter.

2.1.1. INTERNATIONAL CIVIL AVIATION ORGANISATION

International Civil Aviation Organisation (ICAO) was established in 1944 in Switzerland where 52 states signed the Convention of International Civil Aviation, also known as the Chicago Convention. On the 6th of February 1947, ICAO became a United Nations (UN) specialised agency to improve and uniform civil aviation worldwide. Today 191 states have signed the Chicago Convention, including Denmark. ICAO's mandate is to ensure an efficient and orderly evolution of international civil aviation whilst maintaining an acceptable level of safety. ICAO develops and publishes Standards and Recommended Practices (SARPs) in annexes to the Chicago Convention. The SARPs cover all technical and operational aspects of international civil aviation, including safety. Two important points need to be highlighted according to the ICAO Safety Management Manual (SMM) and the ICAO annex 19 Safety Management. First, a State Safety Programme (SSP) is an integrated set of regulations and activities aimed at improving safety (ICAO, 2013b). The SSP is intended for states to work out a management system for the regulation and administration of safety by the state (ICAO,

2013a, 2013b). Second, a safety management system (SMS) allows airlines to systematically identify hazards, collect and analyse data and continuously assess safety risk (ICAO, 2013b) and the SMS must be proportional to the size and complexity of the airline's products and services (ICAO, 2013b).

The first ICAO SMM was released in 2006 (ICAO, 2013b) and many of the preventative initiatives are only 10 years old. Unlike the European Aviation Safety Agency, ICAO has no sovereign power over its member states (Müller, Wittmer, & Drax, 2014).

2.1.2. EUROPEAN AVIATION SAFETY AGENCY

The European Aviation Safety Agency (EASA) is an agency of the European Union (EU) and was established in 2002 by Regulation (FC) No 216/2008 of the European Parliament and Council. EASA was established to ensure a high and uniform level of safety in civil aviation and reached full functionality in 2008, taking over functions from the Joint Aviation Authorities (JAAs), which ceased operations in 2009 (Skybrary, 2014b). EASA was founded partly because JAA had no legal authority within the EU. EASA, as opposed to ICAO and JAA, has regulatory authority through the enactment of regulations by the European Commission, Council of the European Union and European Parliament (IBP, 2012) and, therefore, has regulatory sovereignty over its member states.

As EASA reached full functionality in 2008, many of the requirements and procedures, such as SMS, risk assessments and management of change, has only recently been formalised and effectuated in the aviation industry, where airlines are trying to comply with these regulations.

2.1.3. AVIATION RISK MANAGEMENT SOLUTIONS

A working group, Aviation Risk Management Solutions (ARMS), was set up in 2007 to address operational risk assessment (ORA) in the aviation industry (ARMS, 2010) and supported by the European Commercial Aviation Safety Team (ECAST). The ARMS working group was made up of aviation safety professionals and aimed at producing a useful and cohesive ORA for airlines. The ORA method has been employed by TCAS and will be further elaborated in chapter 2.2.

2.1.4. DANISH MINISTRY OF TRANSPORT AND BUILDING

The Danish Ministry of Transport and Building holds the administrative and parliamentary responsibility for execution of the tasks and implementation of the Danish Parliament decisions concerning the Ministry's field of responsibility (Transportministeriet, 2016). The Ministry of Transport and Building has approximately 140 staff members and assists with the governance and management of the ministerial area containing secretarial tasks, strategic planning and policy formulation. The daily tasks of transport are carried out by a

number of institutions, agencies, councils and boards (Transportministeriet, 2016), including the Danish Transport and Construction Agency and the Accident Investigation Board Denmark.

2.1.5. DANISH TRANSPORT AND CONSTRUCTION AGENCY

The Danish Transport and Construction Agency (DTCA) has approximately 400 staff members who are distributed between seven centers. The DTCA for civil aviation is responsible for safety regulation and supervision regarding safety and security in relation to aviation infrastructure, airlines and aircraft manufacturers, among others (Transportstyrelsen, 2016). The tasks and responsibilities of the DTCA are governed by legislation BEK no 1244 of 10/11/2015.

2.1.6. ACCIDENT INVESTIGATION BOARD DENMARK

The Accident Investigation Board Denmark for civil aviation and railway investigates accidents and severe incidents in the aviation sector in Denmark, Greenland and the Faroe. The Investigation Board is an independent safety investigation authority under the Danish Ministry of Transport and Building. Based on impartial investigations, the Investigation Board presents recommendations to prevent future accidents and incidents to improve safety (Havarikommisionen, 2016). Its investigations do not allocate blame or responsibility, as the purpose is solely to improve safety and prevent accidents. By collecting and analysing data, the purpose of the Investigation Board is to determine the cause or causes and the contributing factors, including development of safety recommendations for improving safety (Havarikommisionen, 2016). The tasks and responsibilities of flight investigations are governed by the consolidated act LBK no 1036 of 28/08/2013 §134 up to and including §144b.

2.2. THE REGULATION REGARDING RISK ASSESSMENT IN RELATION TO AN MOC

A management of change (MoC) has been defined as a "*formal process for systematic and proactive identification of hazards and of appropriate mitigation strategies and measures, to be applied to all changes concerning the safety of services provided by an aviation organisation*" (Skybrary, 2014c). As change is unavoidable in the aviation industry due to new regulations, new destinations, changed procedures, loss of co-workers or new aircrafts, can these changes, be seen as potential hazards for the airline and its operations. As these changes may introduce new or altered hazards to its operations, it is critical to perform risk assessment in relation to MoCs. The process for the MoCs is to identify hazards, implement measures and evaluate the taken precautions in that sequence and to make the process iterative. These changes can be external or internal (Skybrary, 2014c), where external changes include, for example, new regulations, mergers or change of market structure, and internal changes include managerial reorganisations, changes in financial pressure, new operations, equipment and new personnel. The regulation set forth by ICAO and EASA

requires hazards (referred to as the by-product of change) to be systematically and proactively identified and appropriate measures to be taken to manage those hazards.

ICAO (2013b) described the process and practice of an MoC, where an airline "*(…) shall develop and maintain a formal process to identify changes which may affect the level of safety risk associated with its aviation products or services and to identify and manage the safety risks that may arise from those changes*" (ICAO, 2013b, p. 181). The airlines' MoC process should take the following three points into consideration (ICAO, 2013b):

- *Criticality* assessments determine the systems, equipment and activities that are essential for the safe operation of aircraft. Whilst these assessments are generally carried out during the system design phase, they are also relevant during a situation of change. A higher criticality should result in a revision following a change to accommodate corrective actions in relation to emerging safety risks.
- *Stability* of systems and operational environments is necessary as changes may be planned and under the direct control of the organisation. Unplanned changes include those related to economic cycles, labour unrest and changes in the political, regulatory or operating environments.
- *Past performance* of critical systems and trend analyses should be employed to anticipate and monitor safety performance in situations of change. The monitoring of past performance will also assure the effectiveness of mitigation measures taken.

Changes to systems are unavoidable as "*(…) incremental changes can accumulate, requiring amendments to the initial system description. Therefore, change management necessitates periodic reviews of the system description and the baseline hazard analysis to determine their continued validity*" (ICAO, 2013b, p. 182).

The risk assessment process suggested by ICAO (2013b) has been employed to establish a formal process for the management of change that considers (1) the vulnerability of systems and activities, (2) the stability of systems and operational environments, (3) past performance and (4) regulatory, industry and technological changes (ICAO, 2013b). According to ICAO (2013b), the MoC ensures that procedures address the impact on existing safety performance and risk mitigation records before the implementation of changes and that safety assessments of new aviation safety-related operations, processes and equipment are conducted before they are commissioned. ICAO's process in relation to safety risk assessments is illustrated in Figure 1.
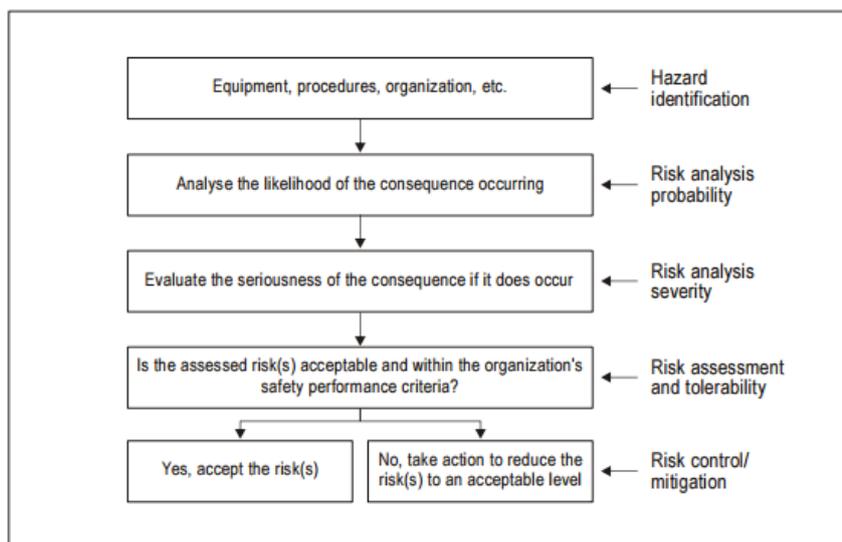
Figure 1 – Safety Risk Management Process (ICAO, 2013b)

As the EU has regulatory sovereignty over its member states, TCAS must adhere to the regulations put forward by EASA. One of these regulations involves the consolidated documents for Organisation Requirements for Air Operations, also known within the aviation industry as Part-ORO. This is a courtesy document intended for easy use, addressing acceptable means of compliance (AMC) and guidance material (GM) to annex III – Part-ORO to Commission Regulation (EU) No 965/2012 on air operations. According to AMC1 ORO.GEN.200(a)(3)(e), this consolidated document states, "*The operator should manage safety risks related to a change. The management of change should be a documented process to identify external and internal change that may have an adverse effect on safety. It should make use of the operator's existing hazard identification, risk assessment and mitigation processes*" (EASA, 2016, p. 26).

TCAS adheres to the ARMS working group operational risk management (ORM) process. The process consists of three elements, hazard identification, risk assessment and risk reduction (labelled risk mitigation in ICAO terminology), where the main objective is to ensure that all risk remains within an acceptable level (ARMS, 2010). A safety assessment is a risk assessment focusing on specific parts of an operation, where ARMS has defined a risk assessment in relation to an MoC as the "*assessment of risk as a result of a predicted/planned change to the operation together with the consequential actions taken, ensuring the safety of the operation due to the change*" (ARMS, 2010, p. 63). The objective is to assess whether part of an operation is deemed acceptable safe (i.e. the risk level is acceptable). The safety assessment is part of the MoC function of the SMS (ARMS, 2010). In the ARMS ORM process for carrying out safety assessment, the first step is to identify and analyse associated hazards where enough quantifiable data are available. However, when this purely consists of soft changes such as change of management structure or outsourcing of a service, then enough

data may not be available and a qualitative approach is best suited for the study. With a qualitative approach, judgements are based on experienced people and the process typically takes place in an evaluation group (ARMS, 2010).

2.3. THOMAS COOK AIRLINES SCANDINAVIA

Thomas Cook Airlines Scandinavia has a long history and has undergone several name changes in its time. TCAS is the official name as of 9 May 2009; the airline was previously known as MyTravel Airways and Premiair. In 1961, Scandinavian Airlines (SAS) established Scanair as the airline's charter company with headquarters in Copenhagen; in 1965 it moved to Stockholm, Sweden. Meanwhile, in 1965, the famous Danish tycoon, Simon Spies, acquired the bankrupt Flying Enterprise and renamed it Conair. In 1994, a merger occurred between Scanair and Conair and the newly created Premiair was established with headquarters in Denmark due to EU membership. In 2002, Premiair changed its name to MyTravel Airways and, in 2012, one of the world's largest travel companies was established through the merger of Thomas Cook Group plc (TCG) and MyTravel Group plc. In 2013, TCAS became a part of the Thomas Cook Group Airlines (TCGA). Today, TCAS is part of TCGA, which is owned by TCG. TCGA is made up of Thomas Cook Airlines Scandinavia (TCAS), Thomas Cook Airlines Belgium (TCAB), Thomas Cook Airlines UK (TCUK) and Condor Flugdienst[1].

TCAS headquarters is located at the Copenhagen Airport (CPH), which is the main international airport serving the capital of Denmark, Zealand and a large part of southern Sweden. In 2015, CPH served 26.6 million passengers and made Copenhagen Airport one of the busiest airports in Scandinavia (CPH, 2016b). The airport is located on the island of Amager, which is 8 km south of the Copenhagen city centre and 24 km west of Malmö city. The airport covers an area of 11,8 square kilometers and is divided into four geographic sections: north, east, west and south (CPH, 2016a). The largest part of Copenhagen Airport is located in the town Tårnby, with a smaller part in the neighboring town of Dragør. The northern area consists of two passenger terminals with train and metro stations, parking facilities and SAS technical facilities covering four large hangars. The eastern area consists of cargo terminals, the veterinary and customs centers. The western area consists of technical repair shops for Copenhagen Airport and the southern area consists of technical bases for airlines, including Thomas Cook Airlines Scandinavia, as well as private hangars and maintenance facilities (CPH, 2016a), see Figure 2.

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[1] Condor is the equivalent of Thomas Cook Airlines Germany. However, due to an unforeseen decrease in passengers resulting from a name change, TCGA chose to go back to its original name.

Figure 2 – Copenhagen Airport (CPH, 2016c)

With almost 100 aircraft, TCGA is one of the world's largest providers of charter travel. The branch that this research studies is limited to TCAS, which consists of Denmark, Sweden, Norway and Finland. As of winter 2015/2016, the fleet at TCAS consists of 14 aircraft divided between four aircraft types. TCAS operates from 32 airports in Scandinavia, with 7 airports so-called primary airports where the aircraft and crew bases are based. In 2015, TCAS's destinations covered 6 continents and its most popular destinations were the Canary Islands, Rhodes, Egypt and Mallorca.
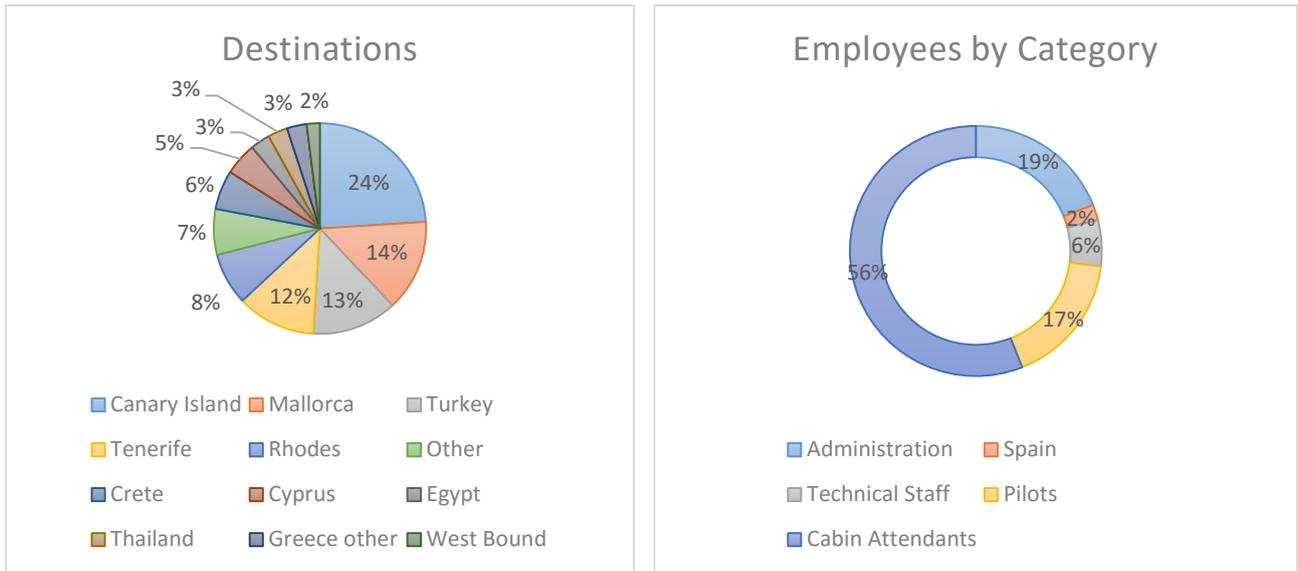
Figure 3 – TCAS's Destinations and Employees by Category

TCAS has approximately 1.200 staff members, with the majority being cabin crew, accounting for 56% of the total staff. The organisation consists of nine departments, four auxiliary sections and the managing director, also known as the accountable manager (AM), as illustrated in the organisational diagram shown in Figure 4. This research is based on four specific departments, which will be elaborated in the next section.

The organisation at TCAS is divided into multiple departments, as outlined below. The focus for this research is on the four most prominent and central departments, where a nominated person (NP) has been appointed. An NP is the head of a specific department who carries the overall responsibility for that department. The AM is responsible for the overall safe operation of the company. The AM is also responsible for providing the necessary resources to the NPs to perform their tasks, as they are responsible, as specialists, to ensure safe operations and airworthy[2] airplanes (TCAS, 2015a). The AM also has corporate authority for ensuring that all operations and maintenance activities can be financed and carried out to the standard required by the DTCA. According to the TCAS internal SMM (TCAS, 2015b), the responsibility for conducting risk assessment in relation to an MoC lies within the specific departments where the MoC takes place.

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[2] Airworthiness may be defined as the fitness of an aircraft to fly when it meets the minimum conditions laid down in its type certificate. An airworthy aircraft is one that is fit to fly (Skybrary, 2016).
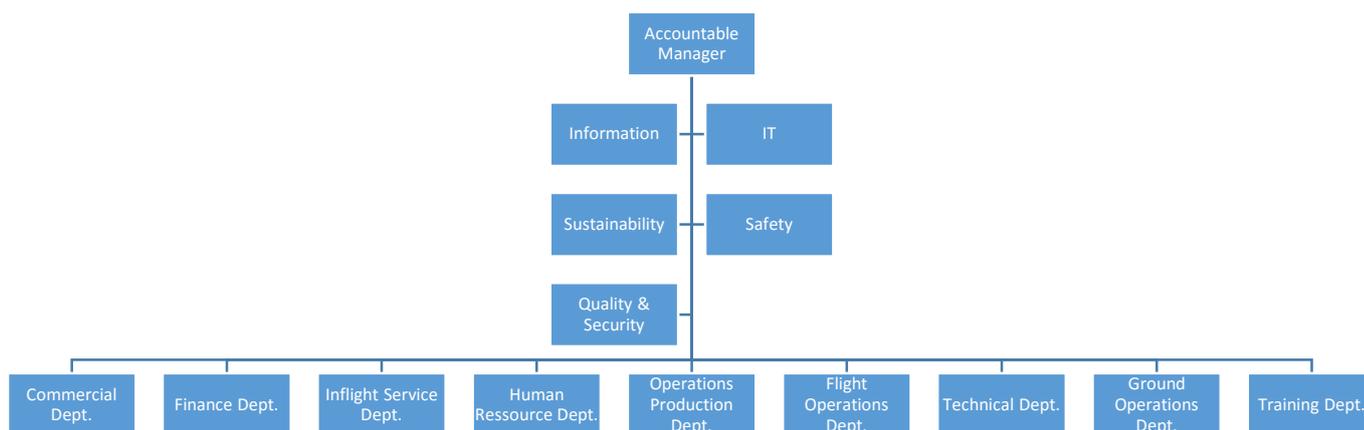
Figure 4 – Organisational Diagram

The four departments chosen for this research have been selected in consultation with TCAS at one of the earlier meetings. The four departments are:

- **Flight Operations (Flight Ops):** Flight Ops is responsible for operating the airplanes, deploying flight crews and standard operating procedures in relation to all aircraft types. Although Flight Ops and Cabin Service in this research have been divided into two departments, the NP Flight Ops oversees the safety of Cabin Service as well.
- **Cabin Service:** Cabin Service is responsible for flight attendants and cabin crews for each flight. Cabin crews are responsible for serving and attending travelling passengers.
- **Technical:** Technical is responsible for technical service and maintenance of flights. Servicing of TCAS aircraft includes activities such as repairing, troubleshooting and routine check-ups, as well as general maintenance. To use the EASA terminology, Technical is responsible for keeping the aircrafts airworthy.
- **Ground Operations (Ground Ops):** Ground Ops is responsible for handling services at all destinations, TCAS crew and passenger accommodation and the aspects of handling the aircrafts at airports as well as aircraft movement around the airports (excluding on active runways). Tasks include preparation of aircrafts before departure through loading of cargo, fuel loading and verification, and de-icing.

This research is based on ten informants from five departments: Flight Ops, Cabin Service, Ground Ops and the Safety department. These ten informants was either an employee, a leader or an NP. Leaders and NPs will in this research be grouped together and referred to as NPs. The research is also, to some extent, based on document analysis of prior risk assessment in relation to MoCs, which has been carried out at TCAS.

THEORETICAL FRAMEWORK

"There are not enough trees in the rainforest to write a set of procedures that will guarantee freedom from harm."

– Jim Reason in (Macrae, 2014, p. VII)

3. THEORETICAL FRAMEWORK

To address the problem presented in chapter 1.3, the theoretical framework will consist of three main themes: the Man-Made Disaster theory; organisational resilience, with an emphasis on precursor resilience; and collective mindfulness, with an emphasis on the first three anticipation principles. Before elaborating on the three main themes, an explanation of the choice of theory will be made.

3.1. CHOICE OF THEORY

Many diverse theories and authors have dominated and surfaced within the realm of safety science. The upcoming subchapter addresses the cultural component of organisational accidents proposed by Turner and Pidgeon (1997). In the Man-Made Disaster theory, organisational accidents happen due to a cultural collapse, in which beliefs about risks and socially accepted norms drift away from reality. It is therefore necessary to explore the social and cultural norms regarding risk assessment, and it is important to see how these risk assessment unfolds and takes place within a socio-technological system such as TCAS. It is also important to see how TCAS's own employees regard these risk assessments. Turner and Pidgeon (1997) are preoccupied with information processing, as he believed that the information needed to prevent disasters lies somewhere in the organisation based on his research. It is therefore important not only for organisations to have and hold the right information but also for that specific information to be allowed to surface from the right persons to these risk assessments. For an organisation such as TCAS, this means that they need to be aware of the prerequisites of their risk assessment processes, as their institutionalised norms can prevent them from obtaining and processing such information. Where a risk assessment focuses on the identification and mitigation of risks, the Man-Made Disaster theory focuses on the organisational activities, which often are given little attention and which are considered equally, if not more, important.

The next subchapter addresses organisational resilience and exploits the two opposites that are considered to exist in the literature. Organisational precursor resilience has been chosen for further investigation in this research, as many HROs want and need to positions themselves within a precursor resilient zone. As noted earlier, organisational resilience is an emergent concept within safety science and has thus been deemed necessary to present divergent views on resilience. This chapter will thus draw upon what Macrae (2014) has termed risk resilience. Where the Man-Made Disaster theory is preoccupied with the understanding of disasters, risk resilience is preoccupied with turning that understanding of disasters or failures into prevention. Risk resilience thus largely builds upon the work of Turner and Pidgeon (1997) and the Man-Made Disaster theory. As this subchapter accounts for the nexus between safety and risk and the challenges inherent in such a discussion, the inclusion of collective mindfulness has been considered essential for this research, as it can provide awareness of the risk assessment process as well as the institutionalised norms.

The next subchapter addresses the theory of Collective Mindfulness, which has been derived from High Reliability Theory (HRT). Specifically, the three anticipatory social processes that are said to be present in an organisation in order for it to have the capacity and skills to uncover adversities in materialising into accidents (Weick et al., 1999). Aven and Krohn (2014) have established the connection between risk assessment and collective mindfulness. As assessments of risk can either be completely ignored or judged as negligible based on the unlikelihood of the risk, one needs to see beyond probabilities and encompass a broader risk perspective, as "*(…) the mindfulness concept with the five characteristics represents sound and useful principles for managing risks, the unforeseen and potential surprises*" (Aven & Krohn, 2014, p. 2). Collective mindfulness contributes to this research as it helps organisations in being watchful of the "*stable processes of cognition directed at varying processes of production that uncover and correct unintended consequences*" (Weick et al., 1999, p. 35). Such unintended consequences, in this research, arise when an organisation disallows its employees from acting on hazards. When organisation instead are willing to see and think about hazards, their employees "*(…) bring new variables under their control and enlarge their ability to act on them*" (Weick et al., 1999, p. 37), thus enlarging the range of issues an organisation can notice. The anticipatory principles from collective mindfulness thus serve as the theoretical framework for achieving organisational precursor resilience.

The last subchapter is a theoretical summary and highlight the link between organisational precursor resilience and the anticipatory principles from collective mindfulness.

3.2. MAN-MADE DISASTER

According to Turner and Pidgeon (1997), there are several indicators and warnings prior to a disaster. If an organisation is able to interpret the information correctly, it should be able to prevent these disasters. Turner's core message from his original 1978 work, Man-Made Disaster, is that a disaster in the information-processing framework is most likely associated with the recognition of the collapse of the existing cultural beliefs and norms about hazards. Through the cultural perspective of disaster, Turner and Pidgeon (1997) are not only preoccupied by physical events but also by the individual's perceptions of events. This is also explicitly expressed through Turner and Pidgeon (1997) definition of an accident:

> "*an event, concentrated in time and space, which threatens a society or a relatively self-sufficient subdivision of society with major unwanted consequences as a result of the collapse of precautions which had hitherto been culturally accepted as adequate*" (Turner & Pidgeon, 1997, p. 70).

The information flow and misperceptions are accumulated over time and undetected between individuals and groups within an organisation. The adversities that accumulate within an organisation in the Man-Made Disaster theory resemble what James Reason has termed latent condition (Reason, 1997; Turner & Pidgeon, 1997).

The Man-Made Disaster theory, or information-processing framework, is a model consisting of six phases primarily associated with the breakdown of information before the accident, as well as after the accident. Little attention is given to the actual impact moment in the Man-Made Disaster theory, also often referred to as a black hole (Roux-Dufort, 2007) because it consumes much of the attention. The Man-Made Disaster theory sees accidents as result of a process and thus contributes to the understanding of the causation of how accidents evolve within an organisation. The Man-Made Disaster is thus characterised as a descriptive theory focusing on information processing and preoccupied with "*perceptual rigidities, information ambiguities, the disregard of rules and instructions, and, eventually, overconfidence and organizational arrogance*" (Turner & Pidgeon, 1997, p. viii). The six phases in the Man-Made Disaster model (Turner & Pidgeon, 1997) are as follows:

| (Notionally) Normal Starting Point | Incubation Period | Precipitating Event | Onset | Rescue | Full Cultural Readjustment |

The information-processing framework is of utmost importance in today's fast-paced organisations. The discrepancies that exist between the accumulated assumptions of risks and hazards in an organisation on the one hand, and the organisational reality on the other, is built up in an organisation due to its existing cultural beliefs and social norms. Cultural assumptions exist in everyday organisational life in its institutionalised practices, which provide the organisation with culturally accurate norms about hazards to enable them to operate and survive (Turner & Pidgeon, 1997). The institutionalised practice takes the form of normative prescriptions, such as informal norms, laws and regulations. What constitutes a disaster instead of an accident in the Man-Made Disaster model is the prolonged discrepancy between assumptions and reality that is permitted to build up in an organisation. This can be exemplified with the analysis of the Challenger accident, where Vaughan (1996, p. 394) states that the National Aeronautics and Space Administration's culture and their "*(…) organisational life that created a way of seeing that was simultaneously a way of not seeing*". A rupture in the information flow is what escalates the disaster or disruption (Turner & Pidgeon, 1997). The Man-Made Disaster is thus seen, as a complementary theory to HRT, as organisational learning and organisational information processing within an organisation is considered crucial. By adopting this explicitly cultural approach, Turner and Pidgeon (1997) see organisations as systems of shared cultural beliefs

and collective assumptions, which influence the information that is considered important and which is attended to by the organisation. This also entails that organisations collectively overlook and ignore information that is not considered important or relevant because of prevailing social culture and norms prevent it. As such, "*collective ignorance*" (Turner & Pidgeon, 1997, p. 116) allows for the accumulation of risks within an organisation.

The problem starts to arise when a discrepancy from the current collective and culturally accepted norm about the formal risk assessment process is discrepant with the reality at TCAS, due to for example collectively accepted norms or procedures of the way of doing such assessments. Turner and Pidgeon (1997) believe that such a perceptual rigidity does not necessarily exist only on an organisational level but can be shared by that of the society. To avoid such disruptions, an organisation has to culturally readjust by learning from minor disruptions and "*(…) not necessarily according to the severity of the consequences which follow from them, but according to their unexpectedness with regard to the prevailing institutionally accepted models of the world*" (Turner & Pidgeon, 1997, p. 128). It is therefore important to understand the context or the social setting in which the risk assessment unfolds at TCAS (Turner & Pidgeon, 1997).

A central criticism to the anticipatory practice of risk management is the often intractable practice of risk management. The Man-Made Disaster model is criticised for being retrospective, as accident causations often become clear and visible only after an accident. Precursor events and information are thus often found to be ignored or not fully appreciated in an organisation following an accident (Turner & Pidgeon, 1997). To explore and mitigate risk in all of its aspects is an infinite and intractable process, because "*the human imagination can concoct infinite modes of destruction*" (Wildavsky, 1988, p. 92). This will result in never-ending risk assessments. Hazards and risks also often do not materialise, or the risks an organisation focuses on might end up being the wrong ones. This is a known phenomenon that has been labelled a "*decoy problem*" (Turner & Pidgeon, 1997, p. 48).

3.3. ORGANISATIONAL RESILIENCE

To define organisational resilience, it is important to address the question of what organisational safety is. It can be difficult to define the things that constitute being safe in an organisation, which in essence is characterised by complexity and ambiguity with inherent and unavoidable hazards. However, to account for organisational resilience and use it as a contribution to the theoretical framework in further research, an exposition of the link between safety, risk, and resilience will be explored.

3.3.1. NEXUS BETWEEN SAFETY AND RISK

Based on the literature, safety in a socio-technical system and its operations are often divided into two categories. In the first category, safety equals the total absence of accidents or adverse outcomes as suggested, among others, by Leveson (2011, p. 11), who defines safety *"(…) as the absence of accidents, where an accident is an event involving an unplanned and unacceptable loss. To increase safety, the focus should be on eliminating or preventing hazards"*. As Aven (2013) points out, the concept of 'absence of accidents' is in conflict with the very nature of the world, as the world is considered to be stochastic, and therefore no one knows whether accidents will occur or not. In the second category, safety is associated with low and acceptable risk, as described by ICAO (2013b, p. 17) as "(…) *the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management"*. The notion that the higher the risk, the lower the safety, and vice versa, has been contested by Möller, Hansson, and Peterson (2006, p. 430), as epistemological uncertainties are inseparable from safety; accordingly, it is "*(…) paramount to go beyond the simple view of safety as the antonym of risk, even if risk is understood in the two-dimensional way"*.

When safety is seen as a condition that exists when adverse outcomes do not occur, safety can be viewed as an epiphenomenon (Hollnagel, 2013). An epiphenomenon is a secondary phenomenon that accompanies and is caused by a primary phenomenon and therefore has no effect of its own. To overcome this problem, safety has been defined as a dynamic non-event[3] (Weick, 1987; Weick & Sutcliffe, 2007). When safety is present, there are no adverse outcomes; this is accordingly labelled a non-event, as nothing goes wrong. Weick and Sutcliffe (2007) explain that safety is both dynamic and invisible, which creates some problems. It is dynamic, because "*what produces the stable outcome is constant change rather than continuous repetition. To achieve this stability, a change in one system parameter must be compensated for by changes in other parameters"* (Reason, 1997, p. 37). It is also invisible in the sense that people fail to realise how often their actions could have resulted in mistakes but did not and that a safe action will not deviate from what is expected, thus resulting in nothing to be aware of. People will consequently continue to act as usual, as they presume that nothing is wrong (Weick, 1987).

As outlined above, safety is difficult to define precisely. No matter how, TCAS, or any other organisation for that matter, looks at safety and risk, it will present some challenges for the organisation. If TCAS correlates total safety with the absence of adverse outcomes, it can be disputed, as the world is stochastic and must be considered to be in constant change, where outcomes may never be fully comprehensible and manageable.

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[3] Although Weick, in his original work, talks about 'reliability as a dynamic non-event', many authors have pointed out the unmissable similarity to safety (Hollnagel, 2013; Reason, 1997).

However, if TCAS associates safety with low and acceptable risk, they reduce the complex world to a simplified view, seeing risk as the antonym of safety. As safety, in Weicks view, is a dynamic non-event, where one can focus on the things that produce a stable outcome, a nexus between safety and risk must be acknowledged to exist. However, the degree between safety and risk must be considered questionable. To overcome such challenges, this research includes collective mindfulness to broaden the risk perspective where not only probabilities are sought, but also a knowledge dimension, the unforeseen and the potential for surprises (Aven & Krohn, 2014). Thinking about risk in this way increases the acknowledgement and incorporation of principles that give weight to uncertainties rather than more mechanical procedures and probability-founded risk acceptance criteria. This broadened risk perspective acknowledges that risks cannot always be measured in an objective way, and thus risk management activities needs to reflect this (Aven & Krohn, 2014).

3.3.2. ORGANISATIONAL PRECURSOR RESILIENCE

Resilience has long been a dominant concept within psychology and ecology and has recently gained attention within crisis management and organisational studies (Boin & Van Eeten, 2013). There has long been a debate about the things that create resiliency and how an organisation becomes resilient. When an organisation faces trial and adversity, a resilient organisation is said to "*bounce back*" (Wildavsky, 1988, p. 77) or even "*bounce back better*" from the starting point (Weichselgartner & Kelman, 2014). Wildavsky (1988) has been considered to be among the first to introduce the concept of resilience in social science in response to the obsession with risk prevention after the Cold War (Comfort et al., 2014). One of the challenges of organisational resilience is that it is not an observable phenomenon; as Boin and Van Eeten (2013) note, resilience is something one presumes must have been present in an organisation that has successfully survived a crisis. As resilience has been, and still is, an emergent concept within organisational studies, the concept faces three conceptual continuums divided by two opposites, proactive and reactive (Comfort et al., 2014). The first continuum is a time-dimension challenge, where resilience can refer either to the preventative activities prior to a disruption or, in the wake of a crisis, to the recovery activities (Boin & Van Eeten, 2013; Comfort et al., 2014; Macrae, 2014). If prior to a disruption, resilience has been labelled 'precursor resilience' and can be defined as the "*ability to accommodate change without catastrophic failure (…)*" (Wise et al., 1993, p. 93). On the other hand, resilience in response to a crisis to bounce back has been labelled 'recovery resilience', and can be defined as "*the ability to respond to singular or unique events*" (Kendra & Wachtendorf, 2003, p. 42). A second continuum relates to the severity of the disturbance and addresses whether resilience should relate only to extreme adversity or also should encompass routine and foreseeable disturbances (Comfort et al., 2014). The third and final continuum between the two poles of resilience is the state of return that resilience has to accomplish. Is the system considered resilient if it returns

to a new status quo, and thus bounces back stronger and better than the initial starting point, or should resilience only make the socio-technical system function again, thus referring to the capacity to remain functioning when a crisis strikes (Comfort et al., 2014)? By ascertaining all three continuums, the following integrative definition of resilience has been proposed: "*Resilience is the capacity of a social system (e.g., an organization, city, or society) to proactively adapt and recover from disturbances that are perceived within the system to fall outside the range of normal and expected disturbances*" (Comfort et al., 2014, p. 9).

As this research focuses on how risk assessments in relation to MoCs contribute to organisational precursor resilience, only one of the *extreme*[4] poles of resilience is pursued. Since risk assessment in relation to an MoC can be considered a proactive method in preventing adverse outcomes from materialising into accidents, precursor resilience will thus be the focal concept. The strength of precursor resilience places resiliency before a disturbance and sees resilient organisations as organisations that "*recognise, adapt to and absorb variations, changes, disturbances, disruptions, and surprises*" (Hollnagel et al., 2006, p. 3); the resilient organisation "*scans its environment, monitors impending changes, and rolls with the punches. A true mark of resilience is thus the ability to negotiate flux without succumbing to it*" (Comfort et al., 2014, p. 8). Although the importance of recovery resilience should not be neglected, it falls beyond the scope of the present research.

While Comfort et al.'s (2014) definition of resilience encompasses the whole spectrum of resilience, it leaves the type of disruptions up for questioning (Macrae, 2014). While drawing upon the work of Turner and Pidgeon (1997) and the cultural component of disaster, Macrae (2014) distinguishes between the material and cultural views of disruptions, ascertaining that the disruption can both be primarily cultural and symbolic as well as material in its meaning. The distinguished meaning of disruption is an important contribution to this research, as adversities does not need to be about errors in the conducted risk assessments but rather may involve errors in the organisational activities. Macrae (2014) therefore largely builds upon the knowledge of the Man-Made Disaster and the cultural understanding of disasters and how to turn that knowledge, into prevention.

3.3.3. SAFETY AS RISK RESILIENCE

Going back to the original question: What is organisational safety? The answer to this question has yet to be determined fully, but by combining safety and resilience, Macrae (2014) has conceptualised *risk resilience*. As discussed above, safety and risk are intertwined and apparently inseparable. Through ethnographic fieldwork and research, Macrae (2014) studied several airlines and their practical understanding of safety

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[4] To use the phrase of the original author (Comfort et al., 2014, p. 8).

and risk management. He found that safety within these organisations is understood in organisational terms "*(…) as an organisational capacity that is produced by networks of defensive practices that protect organisational activity against the potential for catastrophic breakdowns*" (Macrae, 2014, pp. 74-75). In these terms, risk is understood as the deterioration of the organisational capacity to ensure safety and thus entails that organisational risks are systemic deficiencies or weaknesses in safety defences, which leave the organisational activities unprotected, uncontrolled and exposed to potentially catastrophic breakdowns (Macrae, 2014). In conjunction with the above exposition of precursor resilience, safety is thus not understood as resilience to failure, but instead as resilience to risk. Risk resilience is hence "*the organisational capacity to protect against the potential for operational disruptions developing into disabling breakdowns in organisational activity*" (Macrae, 2014, p. 75). Safety is thus not merely about an organisation's capability to predict and forecast probable risks and to have adequate barriers in place but about continual and persistent organisational activities to find and correct deficiencies and to address those safety issues. Organisational safety thus necessitates having systems and work routines in place in order to respond to failures, as well as, and most importantly, making sure that those systems function at all time and are activated when needed. The safety practices that take place should thus be performed routinely and depend on tested and proven practices (Macrae, 2014). Referring to the earlier discussion of the nexus between risk and safety, in Macrae's view, safety should not only be determined by the lack of adverse outcomes or the predicted likelihood and severity of these outcomes but also by the organisational capacity to protect the activities against breakdowns when encountering operational disruptions. Safety is thus absent when the organisational capacity for protecting against risk is considered insufficient (Macrae, 2014).

3.4. COLLECTIVE MINDFULNESS

Based on the empirical research of a group of scholars from the University of California, Weick et al. (1999) link five social processes within HRO that help organisations to suppress propensities towards inertia. A minimum of five social processes provides the cognitive infrastructure that enables an organisation to learn adaptively as well as to provide reliable performance. Collective mindfulness is divided between three cognitive processes that focuses on anticipation before an incident and thus 'expect' the unexpected, whereas the final two cognitive processes deal with the containment after an incident has occurred. This research focuses on the first three cognitive processes, as the risk assessment process in relation to an MoC deals with the prevention of incidents before they materialise. A brief introduction of the last two principles will, however be made, to give a more uniform and holistic insight into the theoretical framework. By separating the two different views on collective mindfulness, the present research seeks to offer a more in-depth analysis of the anticipation area. It is important to emphasise that the researcher does not contest the importance of the last two containment principles. Successful HROs do not ignore foresight and anticipation

but rather recognise and are mindful of their limitations (Weick & Sutcliffe, 2007); as "*(…) unexpected events often force organizations to be reactive rather than proactive*" (Weick & Sutcliffe, 2007, p. 81). As the study focuses on precursor resilience rather than recovery resilience, it will also focus on the principles of anticipation rather than containment in the collective mindfulness theory.

The five social cognitive processes that characterise HROs according to Weick et al. (1999) are illustrated below:

PROCESSES
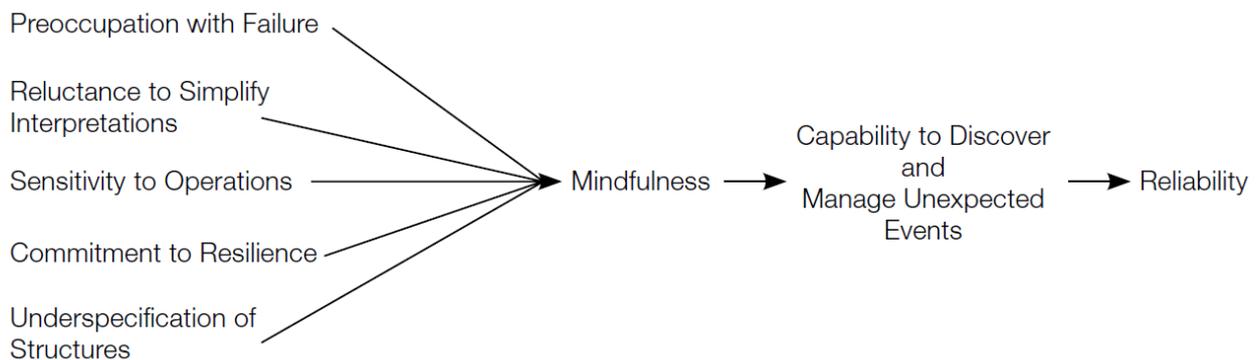
Figure 5 – Collective Mindfulness (Weick et al., 1999)

An important feature of collective mindfulness is that there is a natural variation in the performance at the workplace, but stability in the cognitive processes exists to make sense of this performance (Weick et al., 1999). In this view, reliable outcomes are the result of stable cognition towards the varying processes and performance at the workplace to discover and correct adverse and unwanted events. Thus, the revision of current processes, procedures and problems is only possible due to stable processes of understanding, evidence collection, detection, evaluation, and revising when new events and information emerge (Weick et al., 1999). An analysis of the Diablo Canyon underlines this very characteristic when "*(…) reliability is not the outcome of organizational invariance, but, quite the contrary, results from a continuous management of fluctuations both in job performance and in overall department interaction*" (Schulman, 1993, p. 369). The above illustration of collective mindfulness depicts the five cognitive processes that continuously allows for reliability.

A limitation of HRT is that "*High reliability hazardous organizations are seen as 'rational' in the sense that they have highly formalized structures and are oriented towards the achievement of clear and consistent goals (in this case, extremely reliable and safe operations). They are relatively 'closed systems' in the sense that they go to great efforts to minimize the effects that actors and the environment outside the organization have on the achievement of such objectives*" (Sagan, 1995, p. 17). However, the assertion that HROs are seen

as 'closed system' has been contested by LaPorte (1996). According to LaPorte (1996), HROs are significantly influenced by the external environment and are dependent on external support. HROs require "*continuous attention to both achieving organizational missions and avoiding serious failures requires sustained interaction with elements in the external environment, not only to insure resources, but, as importantly, to support internal resolve to maintain internal relations (…) and to sustain HROs' culture of reliability*" (LaPorte, 1996, p. 65). LaPorte (1996) emphasises that external support for achieving the internal conditions of reliable performance is possibly the most important of all the properties of HROs. LaPorte (1996) expresses that HRO performance is centrally associated with the extraordinarily cooperative behaviour within the organisation itself but highlights that continuous reliable performance would be difficult to sustain in the absence of external re-enforcement. A prerequisite for HROs is therefore to have a stable environment that provides the necessary conditions to continue and develop as a HRO. If the conditions pertaining to the external environment are not stable, HROs would rapidly end up in trouble.

Weick et al.'s (1999) perspective on collective mindfulness is continuous awareness of any adverse information and experiences and using that information as a new frame of interpretation. A rather trenchant contrast exists between traditional organisations, or so-called non-HROs and the exemplary HROs; the focus in non-HROs is pointed towards success rather than failure, and efficiency rather than reliability. Non-HROs thus use fewer of the five social processes than HROs, and therefore non-HROs have a tendency to drift into behavioural patterns resembling a kind of autopilot, or what has been termed inertia or mindlessness, where an organisation fails to acknowledge that a given situation can be perceived differently (Weick et al., 1999). Where the Man-Made Disaster theory see failure of foresight as "*(…) the collapse of precautions that had hitherto been regarded culturally as adequate*" (Turner, 1976, p. 380) should organisations that exercises collective mindful be able to combat against those blind spots. It is therefore interesting for this research to see how TCAS's risk assessment process unfolds and, more importantly, to see if they are displaying collective mindfulness of that process.

The five social processes will be elaborated in the next five subchapters, where emphasis will be placed on the first three social processes.

3.4.1. PREOCCUPATION WITH FAILURE

Analytic error is a chronic worry in HROs and it is this property that gives HROs much of their unique quality (Weick et al., 1999). As HROs seldom see errors, they are preoccupied with failure and convert even small amounts of data into learning points. Contemporary development of organisations leads to organisational processes that seek to avoid errors. However, errors are routinely made, and HROs don't neglect or conceal these errors (LaPorte & Consolini, 1991). Instead, effective HROs encourage the reporting of errors and

ensure that all these reports get full attention. A noteworthy example of this is Landau and Chisholm's (1995) story of a seaman on the nuclear aircraft carrier USS Carl Vinson. The seaman lost a tool and reported it, resulting in a halt of all aircraft landings. Over 100 crew members searched for the tool until it was found. The next day, a ceremony took place to commend the seaman for reporting the lost tool.

HROs stand out from non-HROs in their approach to the consequences of near-misses. Where non-HROs see a near-miss as a state of success, HROs sees near-misses as indicative of impending danger and the reality of safety (Weick et al., 1999). When organisations succeed again and again, they breed confidence and fantasy (Starbuck & Milliken, 1988, p. 329), which make them vulnerable as they become more and more self-confident and trusting of their own competencies. This success leads people to drift towards complacency, inattention and habituated routines, with the justification that they are optimising procedures and cutting away superfluous redundancy (Weick et al., 1999). HROs interprets complacency as a failure of striving, inattention as a failure of foresight, and habituation as a failure of continuous adjustment (Weick et al., 1999).

The preoccupation with failure is not a question of whom, but of what, one can count on (Weick & Sutcliffe, 2007). When HROs is preoccupied with failure, they are preoccupied with maintaining reliable performance, and this is considered a system issue. A system issue focuses on processes and institutionalised deficiencies instead of blaming the shortcomings of individuals. As such, preoccupation with failure should generate knowledge and learning points rather than blame (Weick & Sutcliffe, 2007). Firstly, HROs are predominantly more preoccupied with detecting smaller errors, as they can be clues to additional errors in other parts of a system. Secondly, HROs work harder to anticipate and specify mistakes that they want to avoid (Weick & Sutcliffe, 2007). Although human error still dominates many aspects of modern society (Dekker, 2006; Pettersen, 2008), non-HROs are more likely to fall into the easy trap of appointing blame.

Other researcher (Aven & Krohn, 2014) have also applied collective mindfulness to the more traditional risk assessment process where large uncertainties exist, to broaden the risk assessment scope. In their work, they found that the preoccupation with failure could be strengthened by incorporating the knowledge dimension. The process is started by making a list of all types of risk in regards to the three dimensions: assigned probability, consequences and strength of knowledge. A review of all possible arguments and evidence for the occurrence of these risk events is then carried out. If a risk perspective is aimed at a probability-based perspective, the focus on early signals and warnings will be limited in intercepting and staying sensitive to unforeseen signals and warnings, as early signals and warnings are closely linked to the uncertainty and knowledge dimensions (Aven & Krohn, 2014).
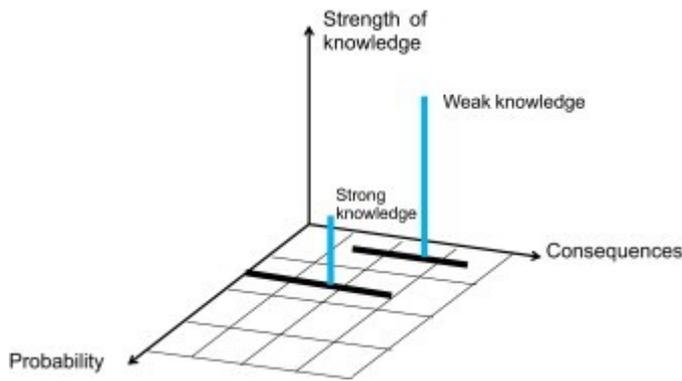
Figure 6 – Risk when incorporating the knowledge dimension (Aven & Krohn, 2014)

3.4.2. RELUCTANCE TO SIMPLIFY INTERPRETATIONS

According to Turner and Pidgeon (1997), all members of an organisation simplify their complex tasks, allowing them to ignore data and keep going. However, too much simplification can be dangerous for HROs, as it limits the foresight and precautions that people take. These simplifications enhance the chance of surprises and allow for the accumulation of irregularities (Weick et al., 1999). This simplification can create an organisation that ignores the same things and overlooks things that can surprise them and lead to potential accidents (Weick et al., 1999). While non-HROs often ignore things they do not know, HROs are conscious of and acknowledge the things that they do not know and thus pay attention to these things. Xiao, Milgram, and Doyle (1997) found that non-HROs socialise their employees to ignore the same things, which leads to employees making several assumptions, whereas HROs socialise their employees to notice more and thus to make fewer assumptions. Non-HROs are therefore seen as a homogenous group of collective thinkers and doers.

To minimize the temptation to simplify complex working tasks, HROs cultivate requisite variety, because they are convinced that a complex system is needed to sense a complex environment (Weick et al., 1999). Requisite variety is closely linked with requisite imagination; the latter refers to the thought and understanding of the ways in which things can go wrong, which allows for a diversity of thinking and imagining of possible failure scenarios (Reason, 1997; Westrum, 1992). Requisite imagination is a paraphrase of requisite variety; the law of requisite variety states that "*only variety (…) can destroy variety*" (Ashby, 1956, p. 207). This means that a system can only protect itself against unwanted variety by possessing at least the same amount of variety. Systematic variety thus requires at least the right variety in responses to deal with variety of unwanted problems. Some of these complex varieties of opinions appear as committees, frequent adversarial reviews, new employees with no prior experience, frequent job rotation, retraining, and meetings (Weick et al., 1999). However, this great effort in matching internal complexity with external complexity is also used as a critique of HROs (Perin, 1995). Perin (2006) describes organisational complexity as an

"*infrastructure of conundrums*", because "*the main problem in complex systems is that designers and operators (…) know that they have not imagined, deduced, or experienced all of the ways it can generate unexpected events*" (Weick & Sutcliffe, 2007, p. 44). Schulman (1993) links requisite variety with conceptual slack, defined as "*a divergence in analytical perspectives among members of an organization over theories, models, or causal assumptions pertaining to its technology or production processes*" (Schulman, 1993, p. 364). These divergent perspectives provide an organisation with a broader insight and variety of inputs about the handling of activities and solutions, rather than what organisations are doing. Although in non-HROs disagreement and conflicts can be provoked by these diverse opinions, HROs put great effort into making sure that the practice and management of disagreement is allowed (Weick et al., 1999). The notion of requisite imagination resembles what Turner and Pidgeon (1997) termed a state of 'variable disjunction of information', where each person holds slightly different information and therefore tends to construct slightly different opinions of what is happening. HROs deal with this by balancing safety and productivity and thus counteract the variable disjunction of information by allocating sufficient time, money and energy in the organisational activities, because HROs deem it relevant and necessary to exchange differing interpretations, unlike non-HROs.

When non-HROs accept simplifications over time, they may in fact end up in the situation that Vaughan (1996) has termed normalisation of deviance, later called practical drift by Snook (2000), where known errors incrementally increase the acceptable risk criteria. A five-step decision-making pattern constitutes normalisation of deviance: 1) signals of potential danger; 2) official act acknowledging escalated risk; 3) review of evidence; 4) discussion of the deviant behaviour where official acts indicate normalisation of deviance, in which a revised working norm is defined; and 5) judgement of risks as acceptable according to the new working norm (Turner & Pidgeon, 1997; Vaughan, 1996). However, by implementing an unusual form of redundancy – scepticism – HROs are able to preserve awareness of simplifications. This type of redundancy occurs when a second opinion confirms, for example, one report, and two observations are made instead of one (Weick et al., 1999).

In Aven and Krohn's (2014) findings on risk assessment and the reluctance to simplify principle, they highlight that decision makers will not allow for judgement of risk to be based solely on simple risk matrices. Based on the earlier discussion of the nexus between safety and risk in chapter 3.3.1, risk should be understood as more than probabilities and consequences. By using the reluctance to simplify principle in risk assessment, one goes beyond the simple view of risks and thus highlights the overall system understanding, the knowledge upon which the probability is based, the signals and warnings, the 'unthinkable' scenarios and

potential surprises (Aven & Krohn, 2014). They further explain that one should not rely on simple rules of thumb, as such rules, whether they are 'truths' or assumptions, can lead to surprises (Aven & Krohn, 2014)

3.4.3. SENSITIVITY TO OPERATIONS

Where preoccupation with failure is about detecting small anomalies in the socio-technical system, and reluctance to simplify refers to the concepts and tools that employees have at hand to do the detecting, sensitivity to operations is about the actual work taking place and about seeing the things people truly are doing irrespective of what they were supposed to do based on procedures, intentions, and agreed-upon work practices (Weick & Sutcliffe, 2007). When HROs are sensitive to operations, Weick and Sutcliffe (2007) argue, these organisations are responsive to the messy reality inherent in most socio-technical systems. Weick and Sutcliffe (2007) refer to sensitivity to operations as the ability to monitor and respond quickly to "*(…) expectable interactions within a complicated, often opaque system and responding promptly to those not expected*" (Perin, 2006, p. XVI).

Weick et al. (1999) draws parallels to 'having the bubble' (Roberts & Rousseau, 1989) and 'situational awareness'. The first is described as a cognitive map that is constructed and maintained, allowing for an integrated big image of the operations (Rochlin, 1997). The latter has been defined as "*(…) the perception of the elements in the environment within a volume of time and space*" (Endsley, 1997, p. 270). When people in HROs are having the bubble, their alertness prevails in catching errors in the moment of misinterpretation, overload, decoys, mixed signals, surprises, near misses, warnings, clues, and anomalies (Weick et al., 1999). When people drift away from this state of alertness, they drift towards "*automation surprises*" (Miller & Woods, 1997, p. 143), which occur when a loss of sensitivity leads people to face an unfamiliar situation and to lose valuable time in seeking the right answer. HROs counteract this by maintaining situational awareness, as this diminishes the occurrence of automation surprises and shortens the period of inaction (Weick et al., 1999). However, the concept of having the bubble might be misleading in the literature. The literature suggest that individuals possess the correct representation of a complex environment, whereas this is not possible in fallible people (Weick et al., 1999). As HROs allows for the interchange of information between people in complex socio-technical systems, individuals thus create a network of bubbles, where shared accomplishment and varying focus coexist between groups of people. Consequently, sensitivity to operations is a collective mental representation where multiple bubbles exist, where information is allowed and wanted to be exchanged freely within an HRO (Weick et al., 1999).

An ideal example of situational awareness is the continual tension between safety and productivity. HROs are more aware of the pressures of overload and its impact on safety issues, such as "*when air traffic controllers gather around a person working a very high amount of traffic and look for danger points*" (Weick

et al., 1999, p. 44). As suggested by Endsley (1995), cited in Weick et al. (1999, p. 44), situation awareness *"emerges from the perception of elements in the environment, the synthesis of discrete elements in order to achieve comprehension of the current situation, and the projection into the future to envision possible future states of the situation"*.

A technological culture is often found within complex technologies operating in complex environments such as nuclear plants, the aviation industry and the Challenger disaster (Vaughan, 1996). This quantitative approach is often considered a threat in HROs, because both quantitative and qualitative knowledge should be weighted equally (Weick & Sutcliffe, 2007). It is important to note that the collective knowledge of failures, details, potential for recovery, and relevant past experience shapes the context in which the present operations either make sense or are reconstructed to make sense, however, this is a product of all five social processes and not solely the sensitivity to operations principle (Weick et al., 1999).

Aven and Krohn (2014), who applied sensitivity to operations to risk assessment, argue that there have been strong indicators of something being flawed in the major accidents that have occurred in the oil and gas industry. Because of poor understanding of risk, precautionary action was never taken in these accidents. It is a challenge for the risk management to take all relevant warnings into account and identify those warnings that are decoy problems. Aven and Krohn (2014) suggest that informative characterisations of risk and uncertainties should be made, but, at the same time, organisations should not abandon the need for value judgements by relevant persons. Aven and Krohn (2014) also highlights the importance of giving weight to uncertainties in the decision-making process; however, a certain amount of care should be exercised, as such uncertainties easily can be misused. The risk assessments should thus be carried out by a professional analyst with no actual share in the risk decision process to avoid biased judgements. Such biased judgements, if risk assessments is conducted by decision makers, give an unbalanced and unfair characterisation of risk and uncertainties, which can be misused to obtain certain goals (Aven & Krohn, 2014). Sensitivity to operations thus involves receiving signals of something threatening the success of these risk assessments, where increased uncertainties requires compensating measures (Aven & Krohn, 2014). To comprehend and manage the unforeseen, in this research in risk assessment, a lot of training is required. Preparation is also needed (Aven & Krohn, 2014; Weick et al., 1999), and the next two mindful processes account for this.

3.4.4. COMMITMENTS TO RESILIENCE

Organisations must sometimes resort to containment, as errors, surprises and the unexpected can be difficult to anticipate. The two remaining social processes addressing containment will be elaborated in this subchapter and the next. Containment differs from anticipation, as its purpose is to prevent unwanted outcomes after an event has materialised, rather than to prevent the event from ever occurring (Weick &

Sutcliffe, 2007). When an organisation is resilient, according to Weick and Sutcliffe (2007), it is mindful about the errors that already have occurred and seeks to correct them before they cause more harm. When HROs are committed to resilience, they quickly recover their stability after an adverse event or are able to maintain and operate their systems under continuous stress. Resilience is said to be a form of control where "*The fundamental characteristic of a resilient organization is that it does not lose control of what it does but is able to continue and rebound*" (Hollnagel et al., 2006, p. 348).

According to Weick and Sutcliffe (2007), resilience involves three abilities: first, the ability to absorb strain and keep functioning despite the presence of both internal adversity (e.g., rapid change or production pressures) and external adversity (e.g., increasing competition); second, the ability to bounce back from unwanted events; and third, the ability to learn from these unwanted events and develop as a result.

3.4.5. UNDERSPECIFICATION OF STRUCTURES

In HROs, hierarchical patterns of authority exist just as they do in non-HROs. The blunt end in non-HROs might get filtered messages about the state of the system, such that they believe that everything is running smoothly. HROs, on the other hand, are aware of this state of mind and have mastered the ability to alter the patterns of structures within an organisation when the situation becomes difficult (Weick & Sutcliffe, 2007). Roberts, Stout, and Halpern (1994) has termed it up and down migrating decisions, because the decision migrates through the organisation in search of a person with relevant knowledge regardless of hierarchical status. Bourrier (1996) calls it a 'very flexible and adaptive organisation' where a formal delegation of power is given to the sharp end supported by almost complete availability of top management at all times; hence, the imminent danger gets full attention at all levels of the organisation. Some HROs do not see it as a formal handing over of power, but as "*(…) a collective, cultural belief that the necessary capabilities lie somewhere in the system*" (Weick et al., 1999, p. 49). Underspecification of structures is thus a heightened sensitivity to temporary problems, where an organisation decouples itself, thereby allowing more people to pitch in and make sense of the event that has taken place (Weick et al., 1999).

3.5. THEORETICAL SUMMARY

By expositing the above theoretical framework, this subchapter both give a theoretical summary and seeks to answer the following subsidiary question:

> **What is organisational precursor resilience and how does it relate to the anticipatory principles of collective mindfulness?**

By clarifying the interrelatedness between safety, risk, organisational resilience and risk resilience, this chapter has elucidated what constitutes organisational precursor resilience. However, as stated above,

simply listing the things that constitute organisational precursor resilience does not give practical guidelines on how to become a resilient organisation. Although many researchers agree with the fact that the precursor resilient organisation is able to "*recognise, adapt to and absorb variations, changes, disturbances, disruptions, and surprises*" (Hollnagel et al., 2006, p. 3) and that it "*scans its environment, monitors impending changes, and [has] (…) the ability to negotiate flux without succumbing to it*" (Comfort et al., 2014, p. 8), it is necessary to look for additional models for obtaining such a precursor resilient organisation. By drawing on the *extreme* end of resilience, the researcher sees the precursor resilient organisation with the ability "*to accommodate change without catastrophic failure (…)*" (Wise et al., 1993, p. 93) and the severity that strain the precursor resilient organisation can be related to both extreme adversity as well as routine and foreseeable disturbances (Comfort et al., 2014). Based on this, the researcher does see a link between organisational precursor resilience and the anticipatory principles from collective mindfulness, as these three principles enhances the organisation to improve its "*(…) capabilities to anticipate and become aware of the unexpected earlier so that people can act before problems become severe*" (Weick & Sutcliffe, 2007, p. 62). When organisations are able to anticipate and become aware of the unexpected earlier, they should be able to recognise, adapt to and absorb variations, changes, disturbances and surprises before they become severe. As the severity refers to a gradation scale it can thus encompass both extreme and foreseeable disturbances depending on how well-developed the social processes are within an organisation pertaining to the anticipatory principles. Although the established relation between precursor resilience and the anticipatory principles from collective mindfulness is merely conjectural, this research uses these three principles of collective mindfulness to provide such a theoretical framework. The anticipatory principles from collective mindfulness can be applied to model and theorise precursor resilience, although such a model and theorisation capture only one measure of resiliency. The theoretical contribution of the anticipatory principles from collective mindfulness can thus offer a rather limited, but nonetheless important, relation between organisational characteristics and processes related to organisational precursor resilience at TCAS.

This theoretical chapter has established the importance of incorporating collective mindfulness anticipation principles in the risk assessment process in order to avoid a discrepancy between the institutionalised norms of an organisation and the external reality (Turner & Pidgeon, 1997). By operationalising collective mindfulness in this research, the researcher is in a position to challenge the tacit knowledge that TCAS has built up over the years in their risk assessment process and uncover potential embedded deficiencies or strengths inherent in their risk assessment activities and relate these findings to characteristics of organisational precursor resilience.

The three theoretical contributions chosen for this research help to address the research questions in three different ways. The Man-Made Disaster gives an understanding of how organisational accidents are caused. It explores the role of the information processing around the risk assessment process in avoiding disruptions of a discrepant institutionalised practice. Where organisational precursor resilience constitutes the things that an organisation, such as TCAS, want to achieve through its risk assessment activities, it is the anticipatory principles from collective mindfulness that function as the necessary instruments to achieve a part of that goal.

METHODOLOGY

"Although risk management has brought greater safety to socio-technical systems, a new approach is still strongly needed."

– Akinori Komatsubara in (Hollnagel, 2011, p. XXVIII)

4. METHODOLOGY

This chapter presents and account for the methodological choices that have been made during this research. The methods used to obtain empirical data to address the research question are presented, as well as perceptions of the research validity and reliability. The challenges that have been encountered will be outlined in their respective subchapter. A qualitative research method has been chosen for this research, as it offers the strength of providing knowledge and understanding of lesser-known phenomena (Danermark, 2002).

4.1. RESEARCH DESIGN

A research design is always implicit in a research study, but several authors believes that it should also be made explicit (Blaikie, 2010; Kerlinger & Pedhazur, 1973; Yin, 2014). As Yin (2014, p. 28) explains, a research design is "*(…) a logical plan for getting from here to there (…)*" while Kerlinger and Pedhazur (1973, p. 300) takes a broader perspective on a research design as *"(…) the plan, structure, and strategy of investigation conceived so as to obtain answers to research questions and to control variance*". According to Blaikie (2010), the research design must account for the choices taken and the reasons behind these choices. The research design can be described as an iterative working tool that controls the process throughout the research. Although the research design ideally is a process where the research question, methodology, empirical data and the conclusion are connected before the research is conducted, it also has the strength of serving as a guideline for the research if one should start deviating from the previously laid out course. These changes can then be taken into account. Some adjustment in this research have been made to account for unforeseen obstacles and challenges, and the research design has been used as a guiding principle throughout the whole process. This chapter focuses on and accounts for the whole research process, so as to ensure transparency and open the research for retesting and criticism.

4.2. RESEARCH STRATEGY

Depending on the research purpose, there are several ways to answer research questions. The research strategy, or logic of the study, provides a starting point and guides the research from questions to answers. The choice of research strategy depends both on the researchers' questions and on the desired outcome. Blaikie (2010) distinguishes among four different research strategies: inductive, deductive, retrospective and abductive.

This research uses the abductive research strategy, which is used to produce understanding by providing reasons (Blaikie, 2010). In contrast to the inductive and deductive strategies, the abductive strategy includes the meanings and interpretations that people at TCAS use in their daily lives and thus directs these peoples

behaviour. The employees at TCAS are largely guided by tacit and mutual knowledge, intentions and rules, which the abductive strategy seeks to uncover. There are two dominant views on the abductive research strategy in the social science literature. Blaikie's (2010) view begins with revealing why people do what they do and identifying the involved actors' points of view to understand the world and the meaning they are giving it. There is a slight but nonetheless important distinction between this and Danermark's (2002) view on abductive strategy. The latter argues that the purpose of abduction is to attain new descriptions, so-called redescription or recontextualisation, where a new meaning is given to an already known phenomenon. To recontextualise, in other words, is "*(…) to observe, describe, interpret and explain something within the frame of a new context*" (Danermark, 2002, p. 91). A significant distinction between Blaikie's and Danermark's abductive strategy is that Blaikie (2010) starts out by focusing on developing technical explanations of lay terms and only then moves on to develop a theory and elaborate it iteratively. Danermark (2002), on the other hand, starts with a notion of something, and through interpretation comes to a new, of multiple plausible, understanding of the same event or observation. By analysing the social phenomenon in a new context, one will obtain new understandings. The social phenomenon in Danermark's abductive strategy therefore relates to the theoretical references for formulating new interpretations and descriptions of the phenomenon (Danermark, 2002). The theory is thus the starting point in Danermark's abductive strategy. Both strategies lean on the hermeneutical circle, where the basic idea of hermeneutics is that one never meets the world without preconceptions (Gilje & Grimen, 2002).

By describing the theory applied before beginning the study and making it the frame of interpretation when collecting and processing the empirical data at TCAS, this research is based on Danermark's view of abductive research strategy. The specific context at TCAS must be taken into account, as the research focuses on the underlying processes, meanings and intentions that are attributed to TCAS risk assessments and its contribution to organisational precursor resilience. The abductive strategy tries, through the informants, to understand the perceived understanding at TCAS and thus seeks to achieve a new recontextualised understanding, which was achieved by asking key informants about pre-determined topics. Through this recontextualisation, the conducted research is able to reach a new context and formulate new interpretations, descriptions, and learning points to addressing how risk assessment activities contribute to organisational precursor resilience.

4.3. ONTOLOGICAL AND EPISTEMOLOGICAL ASSUMPTIONS

Ontology is "*(…) the study of being. It is concerned with 'what is', with the nature of existence, with the structure of reality as such*" (Crotty, 1998, p. 10). The research strategy explained above limits the approach to and understanding of the social phenomenon, because "*ontological assumptions are concerned with the*

nature of social reality. These assumptions make claims about what kinds of social phenomena do or can exist, the conditions of their existence, and the ways in which they are related" (Blaikie, 2010, p. 92). This research study relies on a social reality of shared meanings, thoughts and interpretations through which people at TCAS produce and reproduce the social reality as they go about their daily lives. This study thus falls into an idealist ontological assumption (Blaikie, 2010). Where ontological assumptions are about the nature of social reality, epistemological assumptions are "*(…) concerned with providing a philosophical grounding for deciding what kinds of knowledge are possible and how we can ensure that they are both adequate and legitimate*" (Crotty, 1998, p. 8). It is therefore necessary to identify and explain the epistemological assumption on which this research is based. Just like the ontological assumptions, one are somewhat restricted by the choice of research strategy. This study is restricted to use the everyday knowledge of the people in the phenomenon studied and thus takes a constructionism stance. Constructionism is defined by the fact that no knowledge can be regarded as a true discovery or true knowledge, as everyday knowledge is the outcome of people having to make sense of their encounters with the physical world and other people (Blaikie, 2010; Crotty, 1998). As this research investigates the social context within TCAS and the risk assessments in relation to MoCs and its contribution to organisational precursor resilience, it is impossible to make one true interpretation. The researcher therefore merely suggests one possible interpretation, and this study offers an open invitation for further reinterpretation, or alternate interpretations, by other researchers in the future.

4.4. SOURCES AND SELECTION OF DATA

Before any data can be gathered, some considerations regarding the type of data, including how it will be collected, selected and analysed, must be made. This study undertakes a qualitative approach where two different types of data have been collected. Blaikie (2010) distinguishes between primary, secondary and tertiary types of data. Primary data are those generated by the researcher including the collection and analysis. These are classified as new data, used specifically to answer the research question. Secondary data are raw data, which have been collected by someone other than the researcher, such as statistics. The last category of data is tertiary data, which already has been analysed by someone else and which is used in cases where the raw data might not be available. This research is based on ten interviews with informants and document analysis of three risk assessments in relation to MoCs and one safety risk assessment at TCAS as well as the TCAS internal SMM document. This research is thus based on primary and tertiary data types.

Blaikie (2010) argues that four sources of data exist: natural social settings, semi-natural social settings, artificial settings and social artefacts. The data type for this research come from the semi-natural social setting, which involves asking key informants to answer question about motives, social processes,

institutionalised practices, and themselves (Blaikie, 2010). Even though the research set out to ask informants about their explained behaviour, one must note that there can be a discrepancy between what is reported and what actually takes place. This challenge will be further addressed in chapter 4.6.1, in the discussion on validity and reliability.

4.4.1. CASE STUDY

Yin (2014) argues that case study research would be most appropriate when researching a contemporary event. However, Blaikie (2010, p. 11) contests this, defining the case study as merely "*(…) a method of data selection (…)*" and arguing that a case study is not a research design nor a method of data collection and that its prominent use is to make generalisations that may contribute to the development of theory. What constitutes a case study has no uniform definition or agreement, but Yin (2014, p. 16) offers a twofold definition: "*A case study is an empirical inquiry that investigates a contemporary phenomenon (the 'case') in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident*". Another definition put forward by Berg (2001) gives a more specific definition of methods of the case study: "*Case study methods involve systematically gathering enough information about a particular person, social setting, event, or group to permit the researcher to effectively understand how it operates or functions*" (Berg, 2001, p. 225). This last definition is in accordance with Blaikie's (2010) view of the case study as a methodological approach incorporating a number of data-gathering measures (Berg, 2001; Hamel, Dufour, & Fortin, 1993). As such, this research has not taken Yin's idea and approach regarding the case study, but instead uses the case study as method of data selection, as recommended by Blaikie (2010).

Referring to the research strategy, this research takes a qualitative stance, and Yin (2014) outlines six sources of evidence: documents, interviews, observations, participant-observations, archival records and physical artefacts. This research is based on the first two sources of evidence and is aimed at corroborating the same findings, thus providing data triangulation or convergence of evidence (Yin, 2014).

4.4.2. DOCUMENTS

Several documents, including both publicly available documents and internal documents at TCAS, have been used. Bryman (2012) explains that the use of private documents from the organisation is important, as they give fundamental information regarding the social phenomenon. These documents have helped to shape this research and generate a more valid research design and relevant interview guide for the informants, as they have provided important background information for the researcher. Below is a table highlighting the different documents that have been used in this research:

Owned by:	Document Name:	Year Published:	Available from:	Type of Data:
ARMS	The ARMS Methodology for Operational Risk Assessment in Aviation Organisations	2010	easa.europe.eu	Tertiary
EASA	Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Annex III – Part-ORO: Consolidated version including Issue 2, Amendment 5	2015	easa.europe.eu	Tertiary
ICAO	International Civil Aviation Organisation (ICAO) – Safety Management Manual (SMM)	2008	icao.int	Tertiary
ICAO	Annex 19 – Safety Management	2013	skybrary.aero	Tertiary
TCAS	SMS and Risk Management Presentation of TCAS	2013	trafikstyrelsen.dk	Tertiary
TCAS	TCAS Safety Management Manual	2014	Internal document at TCAS - Confidential	Tertiary
TCAS	Safety Risk Assessment – Hard Landing of Aircraft	2016	Internal document at TCAS – Confidential	Tertiary
TCAS	Risk Assessment of MoC – Change MNPS Procedures Removing the Requirement to Manually Produce a Plotting Chart and Routinely Plot Aircraft Position	2014	Internal document at TCAS – Confidential	Tertiary
TCAS	Risk Assessment of MoC – Expanded Use of Personal Electronic Devices (PED) on TCAS Aircraft	2015	Internal document at TCAS – Confidential	Tertiary
TCAS	Risk Assessment of MoC – New Accountable Manager	2016	Internal document at TCAS – Confidential	Tertiary

Table 1 – Overview of Documents

4.4.3. INTERVIEWS & SELECTION OF INFORMANTS

Andersen (2006) differentiates between informants and key informants, where the latter have important and well-informed knowledge regarding the research topic. The ten interviews that took place in different departments at TCAS has been considered to provide knowledge of the risk assessments in relation to MoCs and therefore offer important insights regarding risk assessment and its contribution to organisational precursor resilience.

The cooperation with a single organisation rather than multiple airlines was a deliberate choice, intended to provide the opportunity to gain a deeper understanding of the concrete risk assessment activities unfolding at TCAS. Using only one rather than multiple organisations has helped this research to avoid sporadic and superficial findings in the allocated time. However, it could have been interesting to compare multiple airlines and their risk assessment process, which could have strengthening the findings of this research as well as the generalisability. Chapter 4.6 will elaborate on the challenges associated with this research, including generalisability and ethical considerations.

By being present in the organisation during the first two months of the research period, the researcher was able to gain a general sense of the best candidates for the interviews. A focus on informants with knowledge of the risk assessments was important. To ensure that all relevant informants was sought out, the researcher consulted with two NPs within TCAS, and the snowball effect (Blaikie, 2010) was used during the interviews to reach the last few relevant informants. The majority of the interviews were conducted during a period of three weeks. There existed an openness at TCAS which provided the researcher with the opportunity to choose freely among employees to be invited for an interview. One informant declined, as the person never had performed a risk assessment, but that informant did recommend another informant from the same department, who was then invited instead. Another informant chose not to attend an interview, as the person did not feel comfortable with risk assessments in general, and this preference was respected by the researcher. The remaining invited informants all attended willingly and cooperatively. The ten informants had a varied amount of experience with risk assessment. It was much easier to find key informants in Flight Ops and Technical than in Cabin Service and Ground Ops. Although all but three of the key informants had only worked with risk assessment in relation to an MoC in the last year, they were all extensively experienced with risk assessment in general.

The informants in this research includes ten informants in total, whereas five of these informants belong to the NP group. The NP group consist of both leaders and NPs. These ten informants comes from five departments: Flight Ops, Technical, Cabin Service, Ground Ops and the Safety department.

4.4.4. CONVERSATION BASED SEMI-STRUCTURED INTERVIEW

The semi-structured interview was considered best suited to this research, as this type of interview functions as a conversation, where pre-defined topics in the interview guide can be supplemented by follow-up questions (Andersen, 2006). The strength of the semi-structured interview is that it both uses an explorative approach to stimulate new knowledge and asks informants to reflect upon pre-defined topics (Justesen & Mik-Meyer, 2010). The interview guide was utilised as a dynamic document, where the questions on the pre-defined topics were adapted to the relevant informant (Kvale, 1996). This ensured that new knowledge or

intriguing questions could be investigated further through the subsequent interviews, cf. the hermeneutics. The interview guide's pre-defined questions were altered with respect, such that the conducted interviews had a uniform structure. Where considered appropriate, overlapping questions were either adjusted or removed. By reflecting and adjusting some of the pre-defined questions for the subsequent interviews with newly gained knowledge, has been considered a strength by the researcher.

Prior to the interviews, an email was sent out, including a brief introduction about the researcher and the undertaken research, the main topics that would guide the interview process, information regarding ethical considerations and a description of the educational study programme. This email was sent to give a preliminary understanding and introduction, such that the informant could generate a sense of closure and trust beforehand. Many of the informants knew the purpose of the project and the researcher prior to the interviews because of the established relations with the researcher and the informants in the first couple of months which the researcher spent at TCAS headquarters. This is believed to have strengthening the relationship with the informants and, most importantly, the truthfulness of the answers they gave during the interviews. The researcher had full support from the NPs, the informants had full disclosure of the research and research problem, which is also perceived by the researcher to be a strength of the research.

All interviews began with a brief introduction regarding the research and why it was conducted and how the informants' answers would contribute to this research. The length of interviews varied between 44 and 85 minutes. All but one of the interviews were conducted as one-on-one interviews, to avoid the possibility of informants influencing each other in a group interview (Justesen & Mik-Meyer, 2010). One interview included two informants from the same department due to time constraints in that department. To get a broad but focused representation of the risk assessments' contribution to organisational precursor resilience, a focus on informants located both vertically and horizontally in the organisation was interviewed. A great amount of attention was focused on the neutral interview technique (Larsen & Vejleskov, 2006) to ensure that the researcher did not influence the informants' responses, although there were a few instances when this process seemed difficult (e.g., when the conversation started to wander too far away from the main topics and out of the scope of this research). To get informants back on the right track, the researcher resorted to asking leading questions, which are often considered a weakness of a qualitative interview (Larsen & Vejleskov, 2006).

To make the informants as comfortable as possible, all interviews took place in a closed meeting room at TCAS. All informants were asked beforehand if the conversation could be recorded with a tape recorder, which all agreed to. This also affected the presence of the researcher, as full attention could be given during the interviews. All interviews were successfully completed, and all questions were covered during these

interviews. At the end of the interviews, all informants agreed to the researcher's request regarding possible follow up questions by mail.

4.5. DATA REDUCTION AND ANALYSIS

Data need to be manipulated into a suitable form for analysis, most often by data reduction techniques. This is a process that is most widely known within quantitative studies, but is also quite relevant within qualitative studies (Blaikie, 2010). Data reduction techniques within qualitative studies are often associated with open and axial coding, which is considered to be a special kind of coding that can facilitate description, analysis and theory generation. Because of the interrelatedness of this process, it is impossible to separate the data reduction and data analysis processes, as the collection, reduction, and analysis of the data are intertwined into one cyclical process (Blaikie, 2010).

The two stages in the coding process are those of open coding and axial coding. Open coding is the process of breaking down data into categories and sub-categories. Axial coding is performed using a coding paradigm that involves thinking about probable causal conditions, contexts, intervening conditions, and the possible consequences of action and interaction to respond to a phenomenon in its context, and the possible consequences of action and interaction which does not occurs (Blaikie, 2010). Based on this analysis process, a core category is selected, and a narrative description of it is constructed (Blaikie, 2010). This type of coding has been defined by Dey (1993) as a spiral process involving three activities: describing, classifying and connecting. This research has been guided by this three-step process, where, for example, the interview guide was divided into pre-defined topics as well as the empirical and analytical chapters. The data from these interviews were derived through transcription using NVivo into text form, which resulted in more concise and clear data to be used for further analysis. Breaking down the collected data into categorised topics, in accordance with Dey (1993), simplified the data analysis. The last step involved the process of coupling the data to discover relationships between the outlined topics and the research question. The document analysis of the various risk assessments in relation to MoCs was likewise analysed on the basis of this type of analysis and categorisation. The last step is to connect the theory with both the document analyses and the data from the interviews, such that a discussion and conclusion about the research question can be presented.

4.6. METHODOLOGICAL REFLEXIVITY

A researcher should highlight both the strengths and weaknesses of the research study (Blaikie, 2010; Yin, 2014). Reflecting on the research, including the design, theory and findings, shows that the researcher has a

good understanding of the research and the results that it produces. Below, such a reflection on the validity, reliability, generalisability, and ethical considerations of the present research has been made.

4.6.1. VALIDITY & RELIABILITY

Validity refers to the empirical data that have been collected and how well they can answer the research problem, while reliability refers to the question of whether repeated measurements on the same empirical data and with the same methods and techniques can reach the same conclusion (Darmer, Jordansen, Madsen, & Thomsen, 2010). At times during this research, a surplus of data was collected through the interviews. However, this excess has been filtered out, and only the relevant data have been used to answer the research question. This is not necessarily a weakness of the research, as this redundant knowledge has contributed to a more holistic image of the organisation's overall risk assessment activities and guided the researcher in the correct direction, while also leaving room for additional data. The strength of the qualitative study method is to provide knowledge of lesser-known phenomena (Danermark, 2002), where a quantitative, questionnaire-like approach would most likely have resulted in better generalisability but more superficial knowledge about the research problem. The qualitative approach, though using fewer informants compared to that of a quantitative study, provides an in-depth and holistic understanding of the specific characteristics of risk assessment's influence on organisational precursor resilience and its contribution, thus increasing the validity of this research.

When conducting research within an organisational setting, the possibility of informants' accurate rendering of truthful answers versus the obligation to remain faithful to the organisation is a threat to the validity of the research (Engen, 2002). By being analytical and critical toward all the collected data, observing the informant's attitude, and observing the time given to the different questions answered by informants, it has been perceived by the researcher that all informants have made their best effort to give truthful answers to the questions. A great effort from the researcher was made to establish the best prerequisites prior to the interviews as well as to elaborate on the different concepts used. Informants were also permitted to skip questions they could not or did not feel comfortable answering; however, while a few informants did use the option of not answering questions due to the fact that they did not know the answers, no informants expressed feeling or were observed to feel uncomfortable answering any of the questions. When informants were unable to answer a certain question, an effort was made to ask in a different way, and a greater focus was given to that specific question in subsequent interviews. Some informants were identified by the organisation, and thus they might have been selected to put the organisation in a positive light. However, the researcher was only directed towards the informants, while the ultimate decision to choose which informants to interview was made by the researcher, which positively influenced the validity of this research.

This research has relied upon both vertically and horizontally placed informants within the organisational hierarchy as sources of empirical data. This research is therefore elucidated from different angles and perspectives, which is believed to have strengthen the overall validity and reliability of the findings and conclusions. Details about the informants were obtained prior to the interview regarding the departments to which they belonged to as well as their experience with risk assessments. This was done to ensure the relevancy of the informants and thus is believed by the researcher to have strengthened the study validity. Based on the above, this research validity is overall regarded as satisfactory.

The categorisation of topics utilised from the beginning of this research, starting with the theory, through the interview guide and collection of the empirical data and finally to the analysis and conclusion of findings, has ensured a common thread throughout this research. By documenting the researchers' desired path and the whole process behind this research, from the initial objectives and goals to the collection of data, including the perceived challenges of this process, has made this research as transparent and consistent as possible and thus is believed to have strengthened its reliability.

As the interview guide and transcription were prepared in Danish and later translated into English, a challenge was encountered in the later process. This process unfortunately induced an inescapable weakness, as much of the vocabulary and technical terms in English are not easily translatable to Danish when the interview guide was prepared and then back again to English after the transcription. The most prominent difficulties were related to the different poles of resiliency. To the best of the researcher's ability, the technical terms were used or the concepts were described to informants and thus could lead to subjective understandings for each individual informant. However, because this is a qualitative study, with the strengths inherent within this method, the informants had and used the opportunity to ask clarifying questions regarding the concepts used. This greatly ameliorated any doubts arising during the interviews and thus remedied much of the challenge. Another challenge appeared during the transcription and analysis process, as many of the informants used figurative and colloquial language in Danish, which was at times difficult to translate while being true to its context. The transcription was done in Danish and later translated into English. The English translations have been quoted throughout this research.

Convergence of findings, as suggested by Yin (2014), should include as many data-gathering methods as possible. This research has relied upon document analyses as well as interviews. A desire to include observations as a data-gathering method, but this was unfortunately not possible because no known risk assessments in relation to MoCs were carried out in the allocated time frame.

4.6.2. GENERALISABILITY

When a single organisation, or a single case, is the subject of a research, generalisation of the findings is often difficult to achieve. Blaikie (2010) is critical of generalising in qualitative studies. It can be argued that such generalisability might have been possible if only using publicly available documents; however, the use of a single organisation was desired by the researcher to uncover and elaborate the tacit knowledge, routines and working procedures of the organisation in order to give a more in-depth understanding of the contribution of risk assessments to organisational precursor resilience in an organisational context. Therefore, an automatic limitation of the generalisability of the research is limited to its context of TCAS. However, Schofield (2002) uses the term 'fittingness' instead of generalisability, where "*the concept of 'fittingness', with its emphasis on analysing the degree to which the situation studied matches other situations in which one is interested, provides a more realistic and workable way of thinking about the generalisability of research results than do more classical approaches*" (Schofield, 2002, p. 178). The ability of fittingness thus require descriptions of the entity studied along with the setting in which the entity operates. Based on the above exposition, the fittingness of this research has been judged to be high by the researcher and of particular interest for other organisations within the aviation setting. In chapter 2, an account of the legislation towards risk assessments in the aviation industry was provided; due to almost the same global legislation worldwide, a significant fittingness is believed to be feasible. The researcher also believes that other industries catching on with risk assessments in relation to an MoC might also benefit from this research, although the fittingness might need to be adapted to the regulation put forward by the respective industrial sector.

4.6.3. ETHICAL CONSIDERATIONS

Bryman (2012) outlines four ethical issues that the researcher faces: harm to informants, lack of informed consent, invasion of privacy, and use of deception. Throughout this research, the researcher has emphasised the importance of keeping informants confidential. By setting up different groups, e.g. an NP group covering the various leaders and NPs to ensure a certain degree of confidentiality was deliberately made. This was also the case with the five departments. The informants' statements has been analysed at the department level in order to de-identify the informants. This was to ensure the confidentiality of informants' and their contribution to this research. However, this can have induced a weakness, as it has resulted in a general overview of the informants, such as; how many informants was interviewed and which department that have been included in this research. The mailing sent out to the informants underlined that the interviews were based on freely given information and that all informants had the opportunity to opt out of either specific questions or the whole interview. Before carrying out the interviews, the same information was again provided to the informants, to ensure that all informants had been notified, as well as to avoid any invasion

of privacy of the informants. Giving informants the opportunity to decline to answer questions also strengthened the validity of the informants' answers, as they were not obligated to provide an answer they were not comfortable giving, thus limiting the likelihood of untruthful answers. Lastly, an introduction to the purpose of the research was given to both the organisation and the informants, to ensure all involved parties had an accurate understanding of the conducted research.

Kvale and Brinkmann (2015) note that the researcher often is positioned as the relatively strongest party in the asymmetrical power relationship that the researcher and informants enter. To overcome this imbalance of power, a great effort was made to assure informants of their contribution to the research. This effort consisted of assurance regarding the conducted research and a desire for mutual collaboration regarding joint interests and the desired outcome, which could benefit both the researcher and the organisation. Although the researcher placed great emphasis on the optional nature of answering questions that could relate to sensitive topics, no such resistance or unwillingness arose during the interviews, and there was a general acceptance and interest in answering all the asked questions.

Some of the documents referred to in this research (e.g., the TCAS SMM) are categorised as non-public documents. A great deal of effort has been made to ensure that the information in this research that stems from these confidential documents has been approved.

4.7. METHODOLOGICAL SUMMARY

This chapter has highlighted the choices made regarding the collection and analysis of data in the upcoming chapters. With this information, the reader is in a position to critically review the validity, reliability and generalisability of this research, as well as the methods involved and how well the collected data corresponds to and answers the research questions. The next chapter presents the empirical data that have been collected at TCAS.

EMPIRICAL DATA

"A risk assessment may not use up all the things that are in the toolbox, as the safety margin will vanish. If you use all the tools and something happens, all the cockpit is left with, is a teat which they can put in their mouth."

– Flight Ops Informant, TCAS

5. EMPIRICAL DATA

This chapter focuses on the empirical data collected by analysing public and non-public documents obtained at TCAS and interviews with informants. Note that even though some of the documents have been labelled 'non-public', permission was granted from TCAS to use them as a reference to its current practice, which will be outlined in the next subchapter. This chapter has been divided into two parts. The first part addresses in detail the current risk assessment in relation to an MoC practice at TCAS. This is based on the document analysis. The second part presents the empirical data from the interviews and focuses on collective mindfulness and the first three anticipatory principles. The second part is thus divided into three subparts, each presenting the empirical findings related to the respective social processes of the anticipatory principles from collective mindfulness. Some areas overlap and the chapter must therefore be seen in its entirety.

This chapter should not be read independently, but in correlation with chapter 2, as much of TCAS current risk assessment activities stems from best practices and legislation put forward by regulators such as ICAO, EASA, ARMS and the national authorities to which local airlines, such as TCAS, must adhere.

5.1. CURRENT SAFETY ASSESSMENT PRACTICE AT TCAS

The risk assessment in relation to a MoC at TCAS will be described below and is based on the internal TCAS SMM as well as three risk assessed MoC documents and a safety risk assessment; see chapter 4.4.2. The purpose of describing the risk assessment process in relation to an MoC is to give the reader the opportunity to see the formal process and how it is conducted. It is important to highlight that the process at TCAS of working with these types of risk assessments has only been operationalised in the last year due to the new regulation, as previously mentioned.

5.1.1. SAFETY RISK MANAGEMENT

The current safety risk management (SRM) practice at TCAS is outlined in its Safety Management Manual and it "*(…) is based on ICAO Doc 9859 – Safety Management Manual, ICAO Annex 19 and takes into account the European Aviation Safety Plan (EASp) and the State Safety Plan (SSP). With respect to the Air Operations, the SMM is compliant with (EU) No 965/2012*" (TCAS, 2015b, p. 12).

5.1.2. OBJECTIVES AND SCOPE OF THE SAFETY MANAGEMENT SYSTEM

Before the risk management process can be described, the scope and objectives of the SMS must be taken into account. As Hale, Heming, Carthey, and Kirwan (1997) stated, safety management is a complex process which incorporates all phases, from design to demolition, of a project or company. The scope of the SMS at TCAS has been stated as follows: "*Use of SMS can be generally interpreted as applying a management approach to control safety risks. Similar to other management functions, safety management requires*

planning, organising, communicating and providing direction" (TCAS, 2015b, p. 14). The objective "*(…) of the Thomas Cook Safety Management System is to provide a structured management approach to control safety risks in operations. Effective safety management must take into account the organisation's specific structures and processes related to safety of operations*" (TCAS, 2015b, p. 13). Some of the key objectives of the SMS are to "*1) Provide a structure which enables safety risks in the operation to be managed, 2) Engage and actively involve all employees in safety, 3) Facilitate the identification of safety hazards and 4) Encourage the reporting of safety hazards and events*" (TCAS, 2015b, p. 13).

5.1.3. SAFETY RISK MANAGEMENT IN RELATION TO A MANAGEMENT OF CHANGE

Safety risk has been defined as "*(…) the projected likelihood and severity of the consequence or outcome from an existing hazard or situation. While the outcome may be an accident, an 'intermediate unsafe event/consequence' may be identified as 'the most credible outcome'*" (ICAO, 2013b, p. 43) and the SRM "*(…) encompasses the assessment and mitigation of safety risks. The objective of safety risk management is to assess the risks associated with identified hazards and develop and implement effective and appropriate mitigations*" (ICAO, 2013b, p. 46). At TCAS, the SRM process is described as starting "*(…) with the identification of hazards followed by an assessment of the risks associated with the hazards, in terms of Probability and Severity, of consequences. Once the level of risk is identified, suitable mitigation measures will be implemented to reduce the risk to As Low As Reasonably Practicable (ALARP)*" (TCAS, 2015b, p. 29). As described above, the risk can be defined by two factors, the likelihood and the severity of consequences. All risks are then compared against the ALARP principle. Every time a change is introduced, a risk must be re-assessed.

If a significant change is eminent and identified by either the Safety & Compliance Action Group (SCAG) or the Safety & Compliance Review Board (SCRB; see chapter 5.1.5), an MoC analysis must take place which includes a list of identified hazard concerns, SRM and proposed risk mitigation or control measures. Based on the identified hazard, the most relevant department will lead the risk assessment process with members co-opted from other relevant departments. The risk assessment is the responsibility of the designated NP and the associated department. However, the NP and department can seek assistance from both the Safety and Quality departments. The risk assessment is carried out with respect to the following three factors: probability, severity and exposure (TCAS, 2015b):

- A probability analysis is established to the level of detail necessary to establish relevant probability values. The value is often estimated from a brainstorming session among the members of the departments involved in the risk assessment on the basis of expert judgement or on the basis of

observed or reference probabilities provided for the sector, type of aircraft, type of operations, type of tool or other element.

- A severity analysis for the worst credible outcome (WCO)[5] is established to the level of detail necessary to establish relevant probability values. The value is often estimated from a brainstorming session amongst the department members involved in the risk assessment. The inputs are often based on expert judgement or on observed or reference probabilities provided for the sector, type of aircraft, type of operations, type of tool or other item. The severity of all WCOs is analysed and the analysis considers both short-term and long-term outcomes.

- Exposure is defined by TCAS as *"(…) the amount over time, number of events, number of people involved, how much equipment [is] involved, the amount of activity during which mishap exposure exists, etc. It identifies generally how many people will be exposed to what hazards and for how long"* (TCAS, 2015b, p. 36).

The last factor, exposure, is not formally documented in the risk matrix at TCAS and is only taken into account on the basis of expert judgement or the observed or referenced exposures provided. TCAS has therefore categorised it as a mental process, which can induce a shift of the risk level if considered appropriate. However, as stated in the SMM by TCAS, the approach to risk management is *"(…) to use the classical risk formula (probability x severity) to create a two-dimensional risk matrix that guides the risk tolerability judgement. By weighing the probability of an undesirable event against the potential severity of its worst credible outcome(s), the risk can be categorised within the risk assessment matrix"* (TCAS, 2015b, p. 36). The risk assessment matrix at TCAS is shown in Table 2 and appendix A.

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[5] The worst credible as opposed to the worst possible consequence, which often would be out of business or a crash.

TCGA Risk and Defence Evaluation Matrix

								What was the effectiveness of the remaining defences between this event and the most credible accident scenario?				
								Effective	**Mostly**	**Partially**	**Min Effective**	**Ineffective**
								numerous effective defences prevented the outcome	few defences failed, a considerable safety margin exists	some defences still in place with remaining defences only partially effective	single defence prevented the outcome	pure luck or exceptional skill prevented the outcome
EVENT RISK If the event had escalated into an accident, what would have been the worst credible outcome?								Probability				
								Almost inconceivable that the event will occur	very unlikely to occur (not known to have occurred)	Unlikely to occur, but possible (has occured rarely)	likely to occur sometimes (has occured infrequently)	Likely to occur many times (has occured frequently)
PROACTIVE What would be the worst credible outcome?								<10E-9	10E-7 - 10E-9	10E-5 - 10E-7	10E-3 - 10E-5	1- 10E-3
								Extremly - Improbable	Improbable	Remote	Occasional	Frequent
		People	Property	Operations	Environment	Media	Reputation	N	1	2	3	4	5
Severity	Negligible	No health effect/ Injury	No damage	No damage / Little consequence	No Impact	No attention	No Impact	1	1	2	3	4	5
	Minor	Minor health effect/ Injury/ First Aid	No evident damage	No evident damage / minor operational influence / use of emergency procedures	No Impact	No attention	No Impact	2	2	4	6	8	10
	Major	Major health effect/ Injury	Local damage/ Technical delay	Longer operational disruptions/ Financial loss/ significant reduction in safety margins / NAA restrictions due to non compliance	Some Impact	Local attention	Local Impact / Pax refuse to fly	3	3	6	9	12	15
	Hazardous	Disability/ Severe injuries	Major damage	Major operational disruptions/ Missed trips	Major Impact	National attention	National Impact/ Airline reputation compromised	4	4	8	12	16	20
	Catastrophic	Multiple fatalities / Loss of life	Loss of aircraft /Equipment destroyed	Removal of certificate of airline/ aircraft	Extreme Impact	International attention	International Impact/ Airline group reputation compromised	5	5	10	15	20	25

Risk Level Definitions % >>	Low 1-5	Medium 6-12	High 15-25

Exposure To Risk +/- 3 (used by Safety Department only)

Table 2 – TCAS Risk Matrix (TCAS, 2015b)

5.1.4. RISK MITIGATION

TCGA and its members have adopted the ALARP risk acceptance criteria. The criteria are established on the basis of safety policy and safety performance targets and address the five following aspects: third parties, passengers and operational personnel, crew members, the natural environment and the organisation's reputation. The ALARP criteria are not exclusively based on fixed-risk targets but involve a systematic and documented process to reduce safety risks below the maximum allowed either by regulations or standards and safety risks otherwise deemed unacceptable. ALARP is defined as "*(...) the safety risk is being managed to as low a level as reasonably practicable whilst at all times staying below the maximum allowed risk*" (TCAS, 2015b, p. 38).

The result of the risk analysis is then compared to the criteria for acceptable risk using the risk tolerability matrix shown in Table 3.

Risk = PxS(xE)	Risk Level	Region	Description	Timeline for Action
15-25	High	Intolerable	The risk is intolerable. Major mitigation will be necessary.	Unacceptable under existing conditions. Immediate remedial action required, not exceeding 7 days following consultation with the relevant member(s) of the SCRB.
6-12	Medium	Tolerable	The risk is of concern. Measures to mitigate the risk/risk review should be accomplished.	Action to mitigate the risk/risk review not to exceed 60 days. A Risk that remains in this range can only be accepted by SCRB.
1-5	Low	Acceptable	The risk is tolerable, however consideration should be given to reducing the risk to ALARP.	The risk may be tolerable but action to mitigate the risk to ALARP may be considered. Risk in this range post mitigation can be accepted by the appropriate SCAG.

Table 3 – Risk Tolerability Matrix (TCAS, 2015b)

The risk tolerability matrix shown in Table 3 is suggested for use in deciding on mitigation measures and their effectiveness. Identification of possible mitigation is based on the risk description and evaluation. When identifying mitigation measures, any new risks that may arise from the implementation of such measures should be identified, as this can initiate another MoC (TCAS, 2015b, p. 39).

Depending on the mitigated risk, or lack thereof, two internal review boards at TCAS exist for further direction, further mitigation or final acceptance of risks. The two review boards at TCAS constitute a high-level committee, the SCRB and an operational safety compliance group, the SCAG. The NP can, through the relevant SCAG, accept risks that falls into the 'low' category, and the AM can, through the relevant SCRB, accept risks in the 'medium' category. Risks that fall into the intolerable region, risks categorised as 'high', cannot be accepted.

5.1.5. TWO REVIEW BOARDS

The SCRB is a high-level committee that addresses matters of strategic safety in support of the AM at TCAS. The SCRB is chaired by the AM and composed of the heads of functional areas, as shown in Figure 7.

Figure 7 – SCRB Structure at TCAS (TCAS, 2015b)

The SCRB's responsibility is to monitor the safety, security and compliance performance against the policies, objectives and targets put forward by TCAS. The SCRB ensures that safety actions are taken in a timely manner and that the SMS is functional and effective. The SCRB reviews the safety risks documented either through the TCAS risk register (see appendix B) or those risks that the SCAG (see below) escalates to the SCRB. The SCRB also provides strategic direction to the SCAG, which must convert those directions into actions. Last, the SCRB ensures that appropriate resources are allocated to achieve the established safety performance at TCAS.

The SCAG monitors operational safety, security and compliance as well as resolves identified risks. The SCAG assesses the impact on safety of operational changes and MoCs as well as ensuring that hazard identification and risk management are conducted. The SCAG consists of three independent groups within TCAS:

- Flight Operations SCAG, chaired by the NP Flight Operations and attended by the NP,
- Engineering SCAG, chaired by the NP Technical, and
- Ground Operations SCAG, chaired by the NP Ground Operations.

The Chair decides the exact composition of each SCAG, but it has as members the senior manager of each area of the department and the designated safety manager, security manager and where appropriate compliance monitoring manager and quality manager (TCAS, 2015b).

5.1.6. SUMMARY

The risk assessment process in relation to an MoC is a process which is easily and heavily influenced by the extensive regulatory framework. Although the risk assessment process must adhere to and meet different requirements, an airline has the possibility of influencing the process, as well as creating organisational activities to promote risk assessments for its employees. The description of the above risk assessment process at TCAS is based on document analyses of several risk assessments in relation to MoCs as well as the

internal TCAS SMM. The above risk assessment process is described as objectively as possible. It has been summarised in the work flow diagram shown in Figure 8 and appendix C.
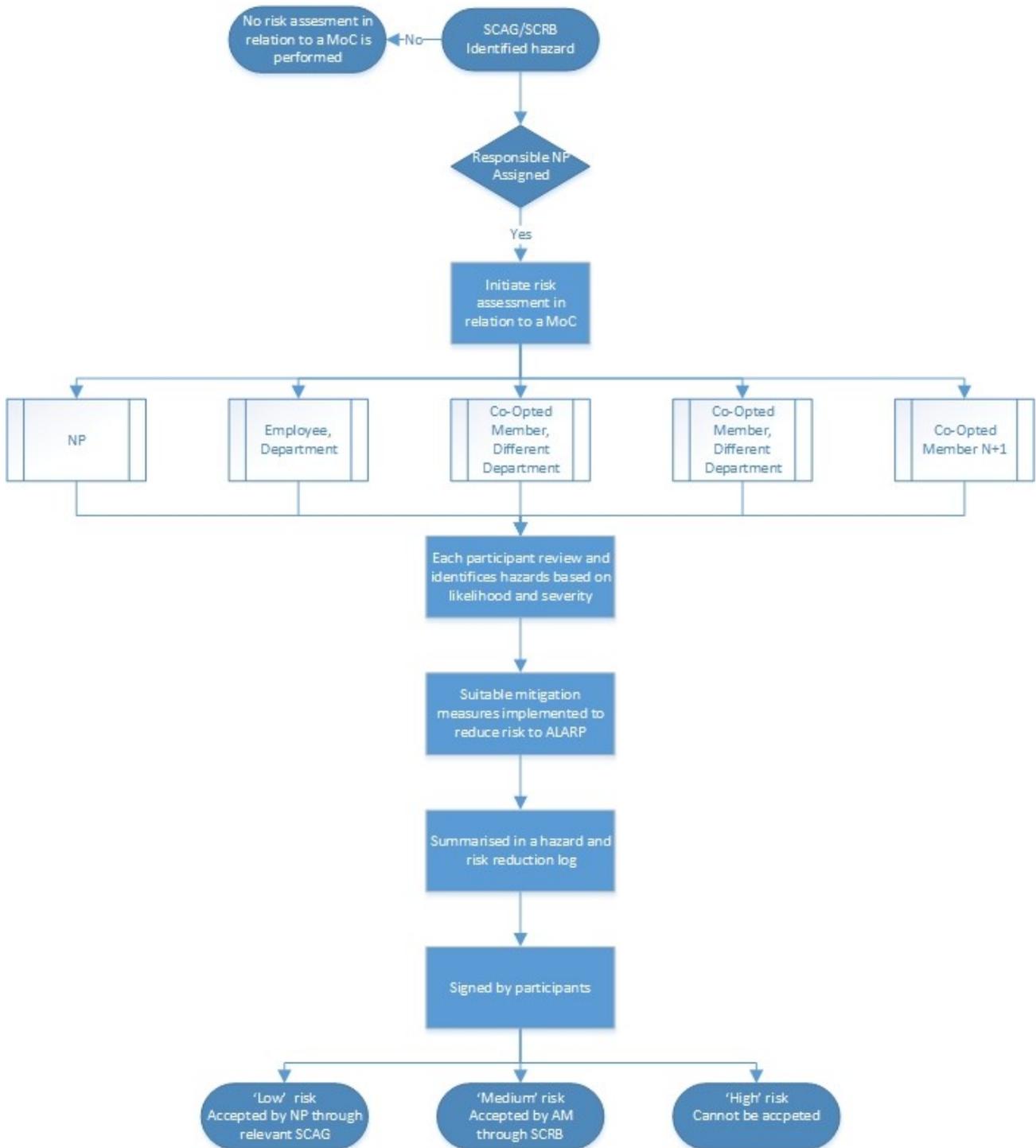
Figure 8 – Workflow

5.2. STARTING AN MANAGEMENT OF CHANGE

Related to the preoccupation with failure principle of collective mindfulness, the informants were asked how TCAS perceived the newly adopted MoC concept as well as how or when it would initiate MoCs. This was to uncover any tacit knowledge and complement the previous chapter regarding the written prescriptive MoC process. Questions were also asked about how TCAS stayed continually alert towards impending MoCs and any perceived challenges with MoCs.

5.2.1. UNDERSTANDING THE MANAGEMENT OF CHANGE CONCEPT

The informants from all departments explained that they all had used MoCs before the term was coined. One of the NPs explained that they had some trouble in the start differentiating between a traditional risk assessment and an MoC. An informant from Flight Ops explained that they had some trouble in the beginning, as an MoC was considered a new thing. The informant said, "*Everyone was talking about it, but no one knew what it was*". According to the informant, the DTCA adopted the rules from ICAO and EASA and required all airlines in Denmark to start using MoCs. However, it didn't offer any guidelines or requirements at the beginning, which resulted in a slow and confusing start, as no one knew what it should cover. Another informant said, "*Not even the DTCA knew what they wanted*".

One informant from Flight Ops explained that the traditional risk assessment was first introduced at TCAS in 2002. In 2005, TCAS made a risk assessment in regards to an 'Around the World' event where multiple destinations and airports were selected by the management. The informant explained, "*It came as a shock for them, as many of the pointed out destinations weren't suitable because the risk was too high*". Traditional risk assessment, as explained by the informant, was started as a bottom-up approach and the new MoC is a top-down approach, as the name implies. Although TCAS differentiates between traditional risk assessment and MoCs, in the ICAO definition, they are in fact one and the same; see chapter 2.2. A Flight Ops informant claimed that "*[we] have always done it [made MoCs], but now it is more official and formalised*" and said that a new airport is seen as a traditional risk assessment at TCAS, whereas using personal electronic devices (PEDs) on board the aircraft is considered an MoC. Another informant from the same department corroborated this by explaining that "*[we] have always used it. We just didn't know that it was called an MoC*" and continued, "*It helps that it has been formalised*". The informants from Technical had the same understanding as Flight Ops and as one informant from Technical explained, "*We have always thought about such risk unconsciously, as we are an industry where things are happening quickly and we are aware of such things*". The informants continued "*(…) but by working more systematically with it [MoCs], we will probably be able to further reduce risks, no doubt about that*". The informant from Technical told about an on-going

example, where the implementation of a new AMOS system[6] is two years overdue since the company does not want to implement it before it works 100%.

One Flight Ops informant described these MoCs as "the Emperor's new clothes" as they already are doing such assessments in that specific department. One NP informant further explained the challenges they have had, as "a*n MoC at TCAS is a relatively new concept. A few have been made and are based on different backgrounds and methods. At TCAS we haven't been very systematic about making MoCs and we need to systematise it better than the current history we have with them*". An informant from Ground Ops explained, "*I believe we lag behind with MoCs because it is a relatively new way of thinking. You can feel it when you talk to people. What is an MoC and when is it necessary? And when you finally start an MoC, you are afraid to make them too complex*".

The empirical presentation throughout this chapter will be based on the definition of MoC presented in chapter 2. This encapsulates both, in TCAS's view, the more traditional risk assessment and the risk assessment in relation to an MoC. To the researcher's knowledge, only three officially termed and conducted MoCs exist at TCAS; see chapter 4.4.2. This creates a restriction for this research, as much of the risk assessment process and activities stem from the hindsight of these MoCs. While the activities towards this process have been implemented due to the learning points from previous MoCs, the usefulness of their organisational activities and initiatives has not yet been adequately tested and verified.

5.2.2. STARTING AN MANAGEMENT OF CHANGE

In addition to the formalised process explained in chapter 5.1, the informants were asked how the management ensures that an MoC is initiated. The informants explained that the initiation of an MoC happens at the management level. TCAS employs several forms of meetings where some occur in their own respective departments, some across departments and, as several informants claimed to be the most important, in their bi-monthly SCRB meeting. Here, according to the informants, they discuss any relation to impending changes. To ensure that the MoC is covered in these meetings, the departments have made the MoC a regular item on the agenda. As one NP informant explained, "*[At these SCRB meetings] we follow up, keep an eye out and discuss impending changes, so we all know exactly where we are and where we lag behind*". The informants explained that at these meetings they discuss any changes and, if needed, makes an initial risk assessment to keep the MoCs on an appropriate level and to separate those considered real threats from trivialities.

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[6] An AMOS system is used for the handling of aircraft parts and determining when such parts should be replaced.

One NP informant explained that "*those [MoCs] I've been involved in have been initiated through SCRB meetings*". This, according to the informants, is how the three MoCs have been initiated and where the SCRB has appointed responsibility for that change. According to the informants, it's thus the duty of that person to involve relevant stakeholders in relation to that specific change, but relevant stakeholders can opt in during these review boards. One NP informant explained, "*We start these risk assessments in relation to an MoC with brainstorming, where we don't try to shoot down ideas*". The NP informant explained that they have been a minimum of three relevant persons from different departments in its brainstorming event. When finished with brainstorming, the responsible person enters the data in a document, as well as any mitigation initiatives, where the probability and severity scale is utilised. After this the NP informant continued, "*Then we send the document around to specialist, NPs and managers to see if we have missed something*".

Because of the mix-up between traditional risk assessment at TCAS and ICAOs definition, an MoC is sometimes initiated from the employees and thus pushed to the NPs through the relevant SCAG or SCRB review boards. An informant from Flight Ops, regarding risk assessment of a new airports, explained that if "*(…) the risk score is 6 or above, it is sent to SCRB for their review to see if we can accept the risk or not*". If the risk score is 5 or below, the informant explained, then it will be sent to the relevant SCAG for further review.

5.2.3. UNCOVERING FAILURES

The informants were asked questions about how they ensured that attention was given to MoCs, such that they stayed attentive for any impending changes. The informants at TCAS explained that they were aware of the possible drift and to combat this, they made sure that an MoC is an item on every agenda, whether a department meeting or a review board. An informant explained, this was to make sure that employees can exchange information across departments and ensure a holistic big image of the operation. A Safety informant further explained that an MoC is assigned to a responsible person, who then ensures that the MoC is conducted within the agreed-upon time in the relevant review board.

To maintain high vigilance and low tolerance of adversies from a change, the informants explained that even when a change is minor or below a risk score of 5, it must be accepted through the relevant SCAG. Any risk that scores a minimum of 6 or above is sent directly to SCRB, where it is discussed and further reviewed. As an informant from Flight Ops explained regarding the so-called risk assessment of a new airport, "*If it's not good enough, they will return it for further investigation*". Another informant from Flight Ops also explained that by using the risk assessment in relation to a new airport, they can address any perceived troubles in that specific airport. The informant is certain that by performing these risk assessments prior to a new airport, they "*(…) have lifted some things and we have closed some. We get to bring stuff up, so we*

feel that we are as safe as we now can be". The informant said that they also are aware that they cannot guarantee a failure-free operation: "*Something unexpected can always happen, but it also means that we add new lines [to the risk assessments], and then we are ready to take it into account the next time"*. One of the things they utilise is a small questionnaire printed for both the pilots and the cabin crew, such that they get new safety information from the field regarding the new airport.

When the informants were asked how they ensured that routines are not habituated to avoid performing risk assessment for the sake of risk assessment or just because they are required to do it, several informants explained that one thing the aviation industry is good at is working with standards, regulations and procedures and knowing when and how to update those procedures. When the organisation agrees to a procedure, in this case an MoC and its process, there is only one thing left to do, and that is to comply with the procedure. The informants also explained that this process is also overseen through internal and external audits. An informant explained that such procedures are updated and adjusted over time if things don't work. An informant from Flight Ops elaborated on the process of how to do an MoC: "*We must not change the process too much, as it will create uncertainty. We must try a procedure for a long time, to see what works and what doesn't*".

Another informant from Flight Ops explained that the person is accustomed to the risk matrix, but that "*[there] are some things I'm not trying to learn by heart. I know what 'mostly' [in the risk matrix] means, but I always sit down and read what 'mostly' means to see if it's the right category*". The same informant compares risk assessment to flying to Funchal in Portugal: "*One can also ask whether it's routine to fly to Funchal? It is not. There are never two identical days [because of the windy weather]*". However, this instance seemed only to apply to that specific department. In chapter 5.3.2, the empirical findings will show how TCAS escalates its risk assessment depending on the degree of complexity.

However, an informant from Flight Ops acknowledged the challenge regarding when to start an MoC: "*It's definitely a challenge to identify the right MoC which needs to be risk assessed. But at the same time, not to identify too many as the challenge will be that it all drowns in noise. We must prioritise to make sure that the right ones are made*". A few informants also explained that the aviation industry is a bit conservative in its thinking; one informant explained that "*(…) once you've got an opinion about something and something new comes along, well, in the aviation industry people are very conservative thinkers*".

The informants from Flight Ops, Cabin Service and Technical explained that, due to the employees' heavy training in safety risk management, the employees are good at informing of potential flaws and concerns when new or altered procedures are developed by the administrative workers. The informants are enthused with the feedback they get from their employees and encourage it. One informant from Flight Ops said, "*It's

nice to have 225 men who looks over one's shoulder. They have many years of training, both pilots and cabin crew, in safety and the maintaining of it. (…) Every time we make a change in their procedures, we will get feedback. When pilots think there is a safety risk, we look in to it". One of the informants from Cabin Service also explained that when quick changes happen everyone can stop and inform others about any safety issues. According to the informant, this is partly due to the open culture between leaders and employees. An informant from Ground Ops explained that because the company hires personnel at the various destinations for the ground operations, employees have a harder time getting that information. The informant explained that the ground workers take a safety course. That course is roughly one and a half hours and is often buried in an eight-hour training day. The informant continued to explain: "*I have a few technicians who are incredibly vigilant and send me 170 emails every day. It's perhaps a little too much, but I don't tell them that because there are sometimes some gems hidden in the information*".

5.2.4. INCORPORATING A KNOWLEDGE DIMENSION

The document analysis, see chapter 5.1, did not reveal that TCAS incorporates a knowledge dimension in its risk assessment and thus it is based on a more traditional risk perspective. Therefore, the informants were asked if and how they included a knowledge dimension in their MoC. An informant from Flight Ops explained that they incorporate a knowledge dimension in their risk assessment process. The informant explained that when the risk assessment is performed, it is sent to the decision makers, in their weekly meetings, the SCAG or the SCRB review boards. The informant continued by saying that if the management has doubt about the assessed risks or wants to have something elaborated, they will be called into those meetings to explain the risk assessments. The informant described an example involving the use of Man-Portable Air-Defense System (MPADS), also known as shoulder-launched surface-to-air missiles, over Afghanistan. The informant explained, "*The SCRB couldn't understand that we would fly in an altitude of 31.000 feet, when the missiles could reach that high*". The informant continued, "*As there was doubt, I was called down to the SCRB meeting and had to explain why we had assessed the risk as we had*". In this case, the informant explained, "*We got live [satellite] feed from Afghanistan, which showed that the snow was so high that these MPADS couldn't be brought up in the mountains, due to the missiles' heavy weight. This was also confirmed by the US Air Force*". The informant continued and explained that they operate with multiple dynamic risk assessment, in this case, one for the winter period and another for the summer period, as they must fly at a higher altitude due to the melted snow in the mountains in that period.

5.2.5. CHALLENGES WITH MANAGEMENT OF CHANGES

The informants were asked about the things that they saw as potential threats or that would hinder the organisation in performing MoCs. The informants all agreed that it is a challenge to know when an MoC is

good enough. One informant from Flight Ops said, "*When it comes to safety, it's never good enough*", while an informant from Ground Ops said, "*I don't think you can say that an MoC is sufficient, as it is a dynamic process. The criteria you used in one day may not be present the following day*". The informants all agreed that the safest thing is to keep the aircrafts in the hangar, but that is not a possibility.

The NP informants explained that they are required by the DTCA to keep up-to-date in their area of expertise and they are audited on this. However, two of the NP informants also expressed a concern towards this way of operating as it could cause a divide between the information that is believed to be true versus the information that is actually true. As one of the informants expressed it, "*The problem is that we might have been in this business so long that we don't see the risks or we may in fact overlook something because we are used to the ways that things have always operated*".

An informant from Ground Ops told two stories about the change of handling agents, one in Scandinavia and another in the Canary Islands. The informant said, "*We made a huge change here in Scandinavia last year. For many years, we have used SAS as our handling agent, but then we changed it to Aviator. It was carried out before we had focus on MoCs, although we made a micro version of the MoC. The whole thing was actually incredibly successful*". The informant continued with a more unfortunate example, "*We had a similar situation last November, where we had a change in the Canary Islands. We switched from a very well-established handling agent to another with a poorer reputation, but with some good prices. Although an MoC was made and several were dubious about the change, nonetheless a contract was signed before any audit could take place*". The informants elaborated that the organisation saved money on the contracts, but because many accidents are currently happening due the change in handling agent, they are starting to cost TCAS money.

Another informant from Flight Ops explained that one of the biggest challenges is the relatively new constellation of TCGA, where employees often need to get answers from the rest of TCGA regarding, for example, a new airport. When the informant thus needs to conduct a risk assessment, the informant said that they now use up to five times the amount of time they used to. The informant said, "*We have been very group oriented and that means that it is no longer those who sit around in TCAS which I need to get answers from*". The informant explained a recent experience with TCUK, where TCUK did not understood why the informant asked about a starter for an auxiliary power unit (APU)[7] for the risk assessment. The informant explained that some destinations, such as Cuba until recently, do not have such an APU starter. This results

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[7] The APU is a small jet engine which is normally located in the tail cone of the aircraft. The APU can, once running, provide electrical power to aircraft systems and for engine start (Skybrary, 2014a).

in a higher assessed risk of the new airport, as the aircraft engine cannot start if the pilot shuts down the APU after landing.

Several informants said that another well-known challenge involved the MoCs and the TCGA regarding their newly adopted incident reporting system, Q-Pulse. Q-Pulse was implemented by TCGA in October 2015. The purpose of Q-pulse was to introduce a common system between the four airlines, Condor, TCAB, TCUK and TCAS. Through Q-Pulse, employees can submit incidents that have occurred in any department and thus provide vital safety information. Although an MoC was made, an informant from Flight Ops said, "*An MoC was conducted on Q-Pulse, but we just haven't seen it*" and continued "*Just in this case, I believe that the management has been beyond reach. The way that Q-Pulse has been built has not been appropriate. It may well be that they comply with ICAO and EASA criteria, but you have lost touch with reality if you do not think about who it is that will be using the tool*".

According to the Flight Ops informant, Q-Pulse provides invaluable insight into safety trends, and currently that change is an issue for flight safety. The informant said that "*(…) the worst thing that can happen is a runway incursion[8] and we cannot see those trends at the moment*". However, several informants also stated that this wasn't only a problem for Flight Ops, but also for other departments. When the informants were asked why such challenges existed, an informant from Technical said, "*When an MoC was made on the Q-Pulse system, it has been done in our sibling companies. When a change is as big and goes across as much, it will be desirable that there are representatives from each company to highlight cultural and local differences. This has not been done*". An informant from Cabin Service further explained, "*We need to be better to perform MoCs and also look outside of our own four walls. We need to be better to say, can I see that MoC? In retrospect, I very much liked that last October we made an MoC, both a group level MoC and a local level MoC*". A last informant from Flight Ops said, "*But again, now we are up on a high management level and we 'rank-and-file' managers cannot really do anything*".

An informant from Ground Ops further explained that the four different companies within TCGA all work in different ways and have different criteria from which to work. The informant explained that an MoC with de-icing of the aircrafts takes up little attention for the sibling company Condor, but is very important for TCAS due to the much colder weather. The informant also explained that the passengers from TCAS make more of a mess than those of Condor when flying to, for example, Las Palmas due to the longer air travel time. This is

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[8] Any occurrence at an aerodrome involving the incorrect prescence of an aircraft vehicle or person in the protected area of a surface designated for landing and take-off of aircraft (ICAO, 2007).

important to bear in mind, as the crews and aircraft most likely will be mixed in the future, as the informant indicated.

5.3. INVOLVEMENT IN AND DECISION-MAKING OF MANAGEMENT OF CHANGES

Related to the reluctance to simplify interpretations principle of collective mindfulness, questions were asked of the informants about how TCAS involved its employees in the MoC process. Questions were also asked in regards to how TCAS's MoC process deals with complexities, its tolerance towards risk acceptance criteria and how it bases decisions in regards to risks.

5.3.1. EMPLOYEE INVOLVEMENT IN MANAGEMENT OF CHANGE ACTIVITIES

When asked about how they are involved in the MoC process and how they allow information to be exchanged regardless of departments, the informants from all four departments said that it is the brainstorming event, which contributes to this. The informants said that the first step of an MoC is to identify the relevant stakeholders. When asked how they identified those stakeholders, one informant from Technical said, "*We are a small organisation and know how it's interconnected. We therefore know exactly the three or four people who will be included in the analysis*". An informant from Cabin Service said, "*It's the brainstorming activity which I learn a lot from. And what the risk assessment learns a lot from*". An informant from Flight Ops explained, "*I think we have a very open culture. If there is anyone who says we need to look at something, we do it. It is not an exclusive club. It mustn't be*".

When the informants were asked how and if they involved people in their MoCs, an NP informant said, "*To avoid silo thinking, we have decided that a minimum three persons should be involved with an MoC, all from different departments*". This is also backed up by several other NP informants, who said the average minimum ranges between 3 and 5 persons who are believed to help their brainstorming towards an impending change. Another NP informant said, "*I can call our worst competitors and ask what they are doing in this case. There is a good information yield between airlines and we have nothing against helping each other*". In addition, the informants explained that by making the MoC an official procedure, they are also in a position to employ several auditing processes.

When the informants were asked if there were challenges in identifying and inviting the relevant stakeholders', one informant from Flight Ops said, "*It's a thing where you can always get better. I would say it is the resources that limit you. The danger of involving too many is that it extends the process dramatically*". Other informants said that what challenges the preparation of an MoC the most are the time factor and resources. They all agreed that the more people you involve, the more perspective you get, but the longer the process would be. One NP informant expressed, "*People believe it's a bit heavy to do*". Other informants

said that it is only a question of time, "*(…) as you start working with an MoC, one's mind-set starts changing and you start to work more formally with it*". Some of the NP informants said that, by discussing the challenges ahead, they can discuss when and what MoCs should be risk assessed. However, according to a Ground Ops informant, the person "*(…) has never been invited for any of the other departments [MoCs], for them, to get my inputs*". The informant continued by saying that they hold monthly operations meetings and the bi-monthly SCAG and SCRB meetings, where different stakeholders can provide inputs to the MoC. However, when the MoC is addressed in those meetings, the informant claimed, "*[we] have our monthly operations meetings where an MoC is a fixed item and we can come with input to the process. But by the time they [the MoC] is mentioned, then they are already set in motion*". The informant continued. "*(…) there will probably always be some employees sitting in the corners who feel that they have been left out*".

Recently, the SCRB started to conduct an MoC on a new information technology (IT) system. One of the NP informants said that one trouble they had is the lack of identifying the right stakeholders from the beginning and believing that the people from SCRB can conduct it alone. Not every assessment can be conducted under SCRB auspices. As the informant explained, "*When I started with the MoC of a new IT system, I have to admit, I slowly groped forward*" and continued "*You need to have people with you*". The informant also said, "*It's something that you tend to skip, by saying that x and y are good at it and they can talk about it. We believe that we know everything about this specific change, but we overlook something and that we actually needed z and w, as they are specialist in this area*".

Many of the informants said that TCAS is a very 'to-do' organisation. According to the informants, any complex and theoretical solutions are therefore not wanted because the people who are going to use the risk assessment tools will not understand them. Another informant from Flight Ops also said, "*I could never dream of showing a bow-tie on a field course because the pilots would say it is long-haired*". An informant from Ground Ops also claimed that "*(…) at TCAS it is safe and simple*", but believes that "*[if] one is afraid of making it complex (…), then you can't fulfil your duty*".

The informants were also asked about the further treatment of a risk-assessed MoC. They explained that after it has been assessed and controlled by the participating stakeholders, it is often sent to the Safety and Quality departments for review. After a review from those two departments, the informants explained that it is most likely sent to the SCRB, which was characterised as the final review. An informant from Flight Ops said, in relation to a risk assessment of a new airport, "*Even when you have conducted the brainstorm and prepared the document, the eight people from SCRB still have to review it*". A NP informant also explained the importance of being able to see who, and how many, has participated in the conducted MoC. The informant said that it is a guarantee for the SCRB to ensure that the assessors have covered the impending

change from different angles. As one NP informant explained, they do not look only at assessed risks, but also at how the brainstorming activity has been carried out: "*As a receiver [of the MoC], the insurance also happens, when you know who has drafted and participated in the MoC. And to questioning if, for example, that only two persons have prepared an MoC*". One of the Safety informants explained that the treatment in the SCRB of the often departmentalised risk assessments contributes to a holistic view, as "*[it] increases the focus on the problem areas and therefore increases the holistic view, which is often lacking*".

5.3.2. ESCALATING THE ASSESSMENT – A DYNAMIC APPROACH

Several of the informants said they have the opportunity to escalate a risk assessment; see chapter 5.2.3. The informants were then asked how and when they escalate risk assessments.

The informants said that the normal risk assessment, or simplified risk assessment as they call them, is a single line assessment for the main change. For example, when the MoC for the AM was performed, the initiating event was that specific change. Thereafter, they used single liners as to what requirements, or challenges, the specific change entailed. The single liner was assessed based on the probability and severity scale; see chapter 5.1.3. However, as one NP informant elaborated, that was a relatively 'easy' change. An informant from Cabin Service is currently reviewing a new IT system and explained "*(…) it is much more comprehensive*".

An informant from Flight Ops also explained, "*If, for example, we acquire new aircrafts, we will conduct an MoC. However, this is not enough. That will be the guiding one. In many departments, especially Flight Ops and Technical, there will be larger risk assessments*".

Another informant from Flight Ops said that when they risk assess a new airport, they have a minimum of 86 items on a list, which they have to cover. The informants said, "*It is single liners with severity x probability. It's simply too exhaustive to make a bow-tie on each item*". The informant elaborated that they have the opportunity to escalate an item into a full-blown investigation using a bow-tie analysis if it is deemed necessary: "*Even though it's single liners, then I'm still looking at the bow-tie*".

When the informants were asked if the process of escalating a certain MoC was thought of more as routine than dynamic, they all said no. An informant from Ground Ops elaborated, "*It would be terrible to standardise it*" and continued, "*You can't do that. It is so individual. They are dynamic and change according to the circumstances*". This was also the view of other informants from the remaining departments.

5.3.3. AVOIDANCE OF INCREASING ACCEPTABLE RISKS

When the informants were asked about how they avoided an increase in the acceptable risk criteria, the informants replied that it was the task of the SCRB to oversee any changes and accept or reject any risks. The

informants said that by having a low threshold towards the risk score in their risk assessments, many risk assessments would automatically go to SCRB for further review and treatment.

A NP informant acknowledged the danger of "*sugar coating these MoCs*" and said, "*there is a danger in these assessments and that is that you may not be completely honest, to make them look good. The challenge here is how to ensure honesty about the risk assessments. We can, clearly, not have some in the red zone, but are we naïve optimists sometimes? Is it the fox guarding the hens?*" Another NP informant also said, "*You can't be political about these assessments, by saying that all risk scores needs to be kept below 6. Then you will destroy any credibility*". An informant from Ground Ops also said that with the MoC regarding the ground handler in the Canary Islands, referred to in chapter 5.2.5, the employees lost trust in management, which they now must re-build. Three of the NP informants linked the question to the culture at TCAS. As one informant from Flight Ops said, "*There is very much self-regulation in this*". This was followed up with both an informant from Technical who explained that "*(…) unless management doesn't have the right attitude, others will not. But, I would say that it is imbued in the organisation*" and an informant from Ground Ops said, "*It sits on the backbone. It sits in a sense of responsibility for your work*".

The informants explained that the importance here is that they have reached an agreement in always having a minimum of 3 persons in brainstorming sessions to avoid such circumstances. Another NP informant said that this is why they made the MoC a recurring item in every meeting – both the weekly and monthly meetings and the SCAG and SCRB. According to the NP informants, the interdisciplinary collaboration between departments at these meetings ensures that transparency exists in the assessed MoCs. An informant further explained that while having made it an accepted procedure at TCAS, they are thus stipulated to be audited by the Quality department.

When the informants in the Flight Ops department were asked about the risk assessment in relation to airports and whether SCRB had neglected a risk assessment to obtain a new destination, they said that it had never happened. The informant explained that in the beginning and before the talk of MoCs and where risk assessment was relatively a new thing in the aviation industry, it has sometimes been 'us and them'. However, when it came to safety, the informant said that there has always only been an 'us'. An informant from Technical also stated that when they put forward safety issues, there is full co-operation from the management. As one informant from Flight Ops said, "*It takes a lot of time [doing risk assessments], it's a part of today's business and we can't live without it*" and continued "*We don't see a risk assessment as a burden. It's the solution to the problem because you can get some answers from the risk assessment so that you can move forward*".

The informant from Flight Ops was then asked what happens if they assess an airport and the final risk score, after mitigation, ends on a 15 or above in the red space. The informant explained, "*We have tried that. We had one in Svalbard in Norway. It ended on [a risk score of] 17 and we just said no thank you. I think that we, in one or two instances, also have said no to a yellow*".

The informant was finally asked if a risk assessment had ever been questioned by SRCB. The informant answered, "*If there is doubt, there is no doubt*" and continued, "*We simply do not dare to take the chance. The one chance that you take results in removing a barrier, which leads to failure of all the other barriers. There has never been any question about them [the risk assessments]. There have been questions about why something was assessed as it was, but never the final risk score*". The informant referred to the example of the MPADS, which was addressed in chapter 5.2.4 and will be further addressed in the following chapter.

5.3.4. RISK-CHARACTERISED DECISIONS

The informants were asked how they based their decision on the assessed MoCs. Many referred to risk assessment under the Flight Ops auspices, as most have been processed in relation to an MoC in SCRB. The informants also explained that the NPs have extensive knowledge in their area of expertise; for example, the NP Flight Ops is a former pilot, the NP Technical is an engineer, and therefore they are familiar with many of the more common risks. Nonetheless, one NP informant said that they quality assure the risk assessment when they go over the details in the SCAG or SCRB. The NP informant said that it is important "*(…) to get the risks out in the open and to get more eyes on them. The specialists must sit in on these meetings, such that we can ask good questions about them and to assure that they are based on valid and proper facts*".

The informants from Flight Ops also corroborate this. The informants said they put a summary at the bottom of the risk assessment, which highlights those risks to which the SCRB must relate. The informants said that "*(…) the 8 persons in the SCRB only have to review a risk if it's a risk score of 6 or above. But we often see that there are questions for those risks with a lower risk score than 6*". The informant explained that this is also insurance for them, as they know that the SCRB has reviewed and discussed the full risk assessment and not only the highlighted risks. If the risk is higher than the risk appetite, the informant also explained, "*Some are also sent back, where they ask if we want to take a certain risk. Then a further assessment and explanation must be prepared. It is quite formalised*".

Such an example on risk-characterised decisions is found in the assessment of the MPADS over Afghanistan, as mentioned in chapter 5.2.4. One NP informant explained that in the case with the MPADS, they "*(…) decided to fly alternate routes. There wasn't anything dangerous in it, but the risk assessment pointed out that it could be bad for public relations or customers' perceptions*".

5.4. ATTENTIVENESS TOWARDS MANAGEMENT OF CHANGES

Related to the sensitivity to operations principle of collective mindfulness, the informants were asked questions about how TCAS shares information across departments and how it ensures attention to MoCs in the daily work routine. Questions about how TCAS gave notice regarding subjective risks as well as perceived challenges of foresight with MoC were also asked.

5.4.1. SCRB AND THE EXCHANGE OF KNOWLEDGE

The informants agreed that the SCRB is the formal place where they exchange knowledge across all departments and inform others about any challenges or impending changes that could have an impact on their own or other departments.

An informant from Technical expressed one of TCAS's strengths as, "*We are a small organisation and we know each other. We know how it all is 'screwed' together*". Although the informant also claimed that a challenge existed when an MoC went across departments, "*[it's] kind of new to us, so we haven't worked so much with it. Sometimes we need to have the holistic view, and when the change affects Flight Ops or Cabin Service, we need to make an MoC which involves multiple stakeholders. The challenge is to find out who the responsible should be [for that change]*".

The two Technical informants described the risk register that TCAS is using. The risk register is an IT program and as soon as a hazard has been identified, it is listed in this register. The informants said that when a hazard has been identified and listed, they perform an initial risk assessment on the item and identify which department the hazard belongs to and assign a responsible person. According to the informants, the risk register then serves as the main hub of the identified hazards. One of the Technical informants said that they have not established any criteria for when such a change or hazard is being raised and when an MoC is needed. The risk register, according to the informants, serves as an easy overview of all risks. Each individual risk then has an underlying risk assessment, either a simple or a more advanced one. The informants explained that the risk register is shared between all head areas, where an NP can assign himself or herself as the responsible party. However, informants from Flight Ops, Cabin Service and Technical identified this as a deficiency. Several informants believed that the risk register should be more open, such that employees can see impending changes, how a risk has been assessed and the chosen mitigations against any potential adversities from a change. However, some controversy existed among the informants regarding how this was implemented. For example, one informant from Technical explained that they wanted only the treated risks; "*We want an openness [in our organisation], so that everyone can follow and see what risks we have. However, it is clear that we will not have an open risk, which is very high (…). You can't just open it up to everyone before the risk has been treated*". The informant from Cabin Service said that "*(…) right now they*

are on SharePoint where five persons plus the safety department have access to it. In a perfect world, all people have access to it". While the informant from Flight Ops said that "*(…) when things are openly available, you keep yourself up on it*".

When the informants were asked how such a hazard would be listed in the risk register and when they would register it, one informant from Technical replied, "*If one brings a hazard we haven't seen, it needs to be listed and we have to deal with it*", followed by another informant who said, "*As soon as there is an item on the list you need to shed light on it*". The informant continued, "*What is a high risk for us doesn't need to be a high risk for someone else*".

The informants from Technical further explained that when they hold these SCRB meetings, "*(…) we discuss any newly added hazards in the risk register, such that we also calibrate it across the departments*". The informants said that because they talk about their risk register, at least at both the SCAG and the SCRB meetings every two months, it helps them to "*(…) go over the risk there has been in that period. In this way we also ensure that we always make an evaluation and see if something new has happened in the concerned areas*". The informant from Technical explained that when they have registered the risk, they automatically start reviewing it. Sometimes there will be several risk assessments, as the initial risk assessment might reveal that they haven't been holistic enough and need to include more stakeholders in the next risk assessment. However, according to an informant from Ground Ops, this poses a challenge; refer to chapter 5.3.1.

The informants explained that because the organisation is small, employees are able to meet up during the day and briefly exchange information with each other. For example, an informant from Technical said that "*(…) we work much together on all levels. That is probably the best reason for a high safety level*". Many of the informants also linked the answers to an open and non-punitive culture. For example, an informant from Ground Ops said, "*We have nothing against helping each other. I'm not afraid of going down to the Flight Manager or down to the Technical department and telling them that I need help. We have a comfort knowing that we can ask questions and get answers*".

When the informants were asked whether employees outside the closed group of SCRB and assessors understood the risk assessments' role and contribution, most of them said no. The informants explained that risk assessment has been mostly the work of a few employees or a few departments.

5.4.2. ROUTINE METHODOLOGY

When the informants were asked whether they were attentive towards MoCs in their daily work routine, an informant from Flight Ops said that TCAS has always been proactively towards SRM. Even before ICAO and EASA requested an SMS, they had implemented it. Another informant from Flight Ops claimed that the

reason risk assessment is so widespread at TCAS today is that it was introduced to the SCRB. A Flight Ops informant elaborated, "*The reason it has been spread throughout the organisation is due to the different representatives in SCRB. They have seen them since, well, 11 years ago. All those who have seen them have gone back to their own department and asked if they have done it. It is through the SCRB that these risk assessments have flowed and they all know what it is about*". However, another informant from Flight Ops said that the employees who do not regularly become involved in the assessment activities often see it as "*gibberish talk*" and "*(…) it's often perceived as something the Safety department deals with*".

The informant from Flight Ops was asked if it helped that ICAO and EASA made it an explicit requirement, such that airlines should work with risk assessment in relation to an MoC. The informant claimed that it has helped. However, the informant is also certain that it will take a long time if no one pushing the idea.

Several NP informants claimed that it is a benefit that the procedure of performing MoCs has been made an internally agreed-upon standard at TCAS. By enacting the risk assessment in relation to an MoC as a standard, they can audit, follow up on meetings and ensure that the MoC is performed satisfactorily. As one NP informant said, "*The underlying system and processes and when to review these things is very hung up on the systematic way you have towards the procedure for risk management and the risk register*". The informants explained that "*(…) it forces people to think towards these things, if it doesn't naturally comes up during your day*". Another NP informant explained that due to the enacted procedure, over time the Quality department can review and assure that the MoC and its process have been conducted as agreed upon. One informant explained, "*We have a quality system, which over time ensures that we have done as we have agreed we would. For example, they investigate us if at least three departments have participated and ensured the MoC*".

The informants also claimed that tension also exists. On one side, the routines help in conducting and performing MoCs, while, at the same time, they need to find a balanced way to do them in proportion to time and resources. One NP informant explained that "*(…) you have to be careful not to over-bureaucratise it*" and continued, "*After all, this is why we have our bi-monthly SCRB meetings*".

When the informants were asked about the factors, which contribute to being attentive to conducting MoCs, one of the informants from Technical said that it was the routine. The informant claimed that by having a routine about it, one starts thinking about it subconsciously. Another informant from Flight Ops explained that it is the understanding of the process that contributes. As the informant explained, "*When people obtain an understanding, they will then know that they are a part of a bigger puzzle*".

5.4.3. SUBJECTIVE RISKS

The informants were asked question about what Vaughan (1996) termed a technological culture and how they handle less technical and more subjective risks.

The informant from Flight Ops said that in their earlier days it was rather difficult, as their risk matrix was "*not as guiding as it is today*". The informant explained that TCAS has made every category explicit (see chapter 5.1.3), which has helped non-experienced employees assess and categorise risks. Although it has helped characterising these risks, the informants explained that some are more difficult to classify in such a 'box system'. One informant said that "*(…) it can be difficult to slam it into such a box. But again, if we are discussing it based on a box system where you have the red, yellow and green, then one can most often without valuing them and actually argue, from this perspective and that perspective, that a risk should be put here or there*".

The informants from Technical said that they favoured the more technological approach in the risk matrix, as it made more sense to them. Even though they termed themselves "*engineer-heads*", they also said that, because people have different experiences in their field of work, there would always be different assessments. The informants said that if such differences arose, they would set up meetings, such that an exchange of knowledge, experiences and a calibration can take place.

An informant from Flight Ops also said that they have statistics on nearly everything. For example, "*There are statistics on how often the Cabin Crew experiences angry customers. Our risk matrix for risk assessments is translated into clear text, so everyone should be able to understand them*". The informant explained that over time, the cabin crew is able to differentiate on the severity scale. Informants from Cabin Service also verified this.

Another NP informant referred to the same story of the MPADS, as explained in chapters 5.2.4 and 5.3.4, where such subjectivity appeared in an SCRB meeting. Even though the risk assessment cleared the flight path going over Afghanistan in what seemed a low altitude, the informant claimed that "*[we] do it at SCRB. If there is anything we do not like, but cannot put a finger on it, we discuss it. It's green, green, green, but there is something I don't like*".

5.4.4. CHALLENGES OF FORESIGHT

The informants were asked about the challenges of maintaining an attentiveness towards the risk assessments in relation to MoCs. Several informants linked their answers to having sufficient competencies and allowing themselves sufficient time for these assessments.

Several informants explained that in the latest SCRB meetings, they have had the same MoC in review. The informants said that they started a bit late, so that the change was implemented before the MoC was conducted. The informant from Flight Ops said that "*(…) It's up every time [at the SCRB]. It's not good enough, but we have one that hangs and it's a mistake. It's because we are fairly new at this*". Another informant from Technical said, "*We do have the resources. There where we might lag is that at the administrative level; it sometimes takes a little longer that it might otherwise have done. But it will never affect safety*".

Many of the informants from the Safety, Technical and Flight Ops department expressed gratitude for having a partner for discussion. As one Flight Ops informant said, "*We are so lucky that we have two men working on this. (…) This is important because what I don't detect, the other will pick up*". This is not the case with the Ground Ops department. Although the department has an extensive network upon which to draw, the department is relatively small.

An informant from Cabin Service also stated that the further you move from the core group of people involved in the MoC and risk assessment process, the less training and experience you have with such assessments. The informant explained that, even though the person is part of the group, the person relatively infrequently participates in risk assessments and MoCs due to time pressure and proficiency. The informant explained, "*I have been on the [SRM] training, but it wasn't adequate. Before you are really good, you need to have more training. Then you are also forced to be more practical and then you have the best requirements to learn*".

The informants indicated that the Technical and Flight Ops departments had the most extensive knowledge of MoCs and risk assessment. One of the informants from Flight Ops said, "*It lies in our DNA and education to think about safety*". During the interviews, almost half of the informants referred to one of the informants from Flight Ops as a person of interest. Many of the informants described and characterised one specific informant from the Flight Ops department as what Westrum (1992) termed a *maestro* because the person's extensive knowledge of safety risk management

ANALYSIS

"Slack. The term reeks of inefficiency."

– Paul R. Schulman in (Schulman, 1993, p. 353)

6. ANALYSIS

This chapter analyses the empirical data presented in chapter 5 using the applied theoretical framework in chapter 3 to answer the research problem stated in chapter 1.3. This research operationalises the anticipatory principles from collective mindfulness to draw lines between the risk assessment activities in relation to an MoC at TCAS and how those activities can be transferred to, or resemble, characteristics of organisational precursor resilience. To do so, this chapter will be divided in four subchapters, with the first three subchapters accounting for the anticipatory principles. The last subchapter will explicitly answer the problem outlined in chapter 1.3. The subsequent three subchapters therefore seek to answer the following subsidiary question:

> *In what way is Thomas Cook Airlines Scandinavia collective mindful in its risk assessment activities in relation to a management of change and how is this reflected throughout the organisation?*

As some of the topics in the upcoming three subchapters overlap, it has been difficult to separate the empirical data entirely. The analysis must therefore be read in its entirety to ensure holistic and comprehensive coverage of the analysis of empirical data in relation to the theoretical framework.

This chapter takes an opposite approach to the theoretical framework. Using the anticipatory principles as a framework to operationalise organisational precursor resilience allows for answering the above subsidiary question in the upcoming three subchapters, each pertaining to one of the three anticipatory principles. The three subchapters should be seen as building to the fourth and last subchapter, which offers an analysis of how the anticipatory principles of collective mindfulness relate to characteristics of organisational precursor resilience.

6.1. PREOCCUPATION WITH FAILURE

An organisation's chronic worry about errors in its ongoing activities is the first principle of collective mindfulness and an important element of foresight in risk assessment in relation to an MoC. According to the theoretical framework described in chapter 3.4.1, a limitation of foresight can in fact amplify an organisation's chronic and analytic errors. The empirical findings in chapter 5.2 show how TCAS stays attentive to failures in its risk assessment activities in relation to an MoC. This subchapter analyses the empirical data based on the theoretical framework to explore whether TCAS is preoccupied with failures in its risk assessment activities.

6.1.1. THE EMPEROR'S NEW CLOTHES

Chapters 5.2.1 and 5.2.2 present the empirical data regarding how risk assessments in relation to MoCs were perceived and started by TCAS, adding to the practices outlined in TCAS's written procedures in chapter 5.1. Although such MoCs are explained and considered to be "*the emperor's new clothes*" by some departments, challenges exist regarding when such MoCs are thought to be started, whom to involve and their degree of complexity. This is the starting point of this chapter, as it generates interesting areas, which this chapter seeks to uncover and elaborate.

According to the informants, the process regarding risk assessment in relation to MoCs has been sporadic in all but one department. The empirical data indicate that the Flight Ops department introduced risk assessment to TCAS in 2002. The Flight Ops department has then slowly spread the message to other departments through the SCRB; thus, over the years, the Flight Ops department has grown accustomed to working with these types of risk assessment. However, according to the empirical data, the SCRB has based its recent MoCs on different backgrounds and methods. This process might be considered an inadequate sporadic approach at first glance. However, one can argue that these different approaches have created small amounts of data points through trial and error. Learning from possible shortcomings as well as what worked well in the activities from the previous MoCs has, in fact, transformed these data points into learning points towards the SCRB's current risk assessment activities in relation to MoCs. Such learning points can be attributed to the internally agreed-upon procedure regarding how it should be processed in the SCRB and how it should be assessed by a minimum of three persons. It can therefore be recognised as what Weick et al. (1999) termed analytic worry towards errors.

6.1.2. UNCOVERING THE 'UNEXPECTED'

The empirical findings in chapter 5.2.3 demonstrate that TCAS stays attentive to failures and errors. TCAS has implemented and utilised a rather low threshold for risks. Any risks that carry a risk score of 5 or below in TCAS's Risk Tolerability Matrix should be treated in the SCAG. In contrast, any risks that carry a risk score of 6 or above are sent directly to the SCRB for further actions or treatment. The three different risk assessments in relation to an MoC and the one safety risk assessment which the researcher has reviewed (see chapter 4.4.2) had at least one risk that was assessed with a risk score of 6 or above. This indicates that the SCRB stays up-to-date about any changes that can affect its department or the organisation as a whole. Enforcing such a low threshold towards risk should result in any impending changes, whether new procedures, aircrafts, handling agents or airports, being discussed broadly among the diverse stakeholders from the different departments. The SCRB thus creates space for its members without an actual share in a specific change to question either the process or the assessed risk of such impending changes.

One of the challenges, which two of the NP informants described in chapter 5.2.5, was that the NPs need to have a specific background to function and be instated as an NP for an airline. According to the empirical data, this could create a divide in specific departments because such a department quickly resembles and constitutes a homogenous group of thinkers and doers (Weick et al., 1999). However, risks that need to be addressed and treated amongst several members from different departments in the SCRB without such specific knowledge might contribute TCAS in making fewer collective assumptions. When risk assessments can be questioned by other departments, the assessing department must reflect on the assessed risk and, if needed, the assessor must 'stand trial'. At the same time, such questions require SCRB members to know what to look for and what questions to ask. However, it might be difficult for Ground Ops or Cabin Service to know what questions to ask Technical in a risk assessment.

According to Weick and Sutcliffe (2007), HROs are predominantly more preoccupied with detecting smaller errors because they can be clues to additional errors in other parts of the socio-technical system and thus encourage the reporting of errors. The empirical data indicate that this is primarily an advantage restricted to Flight Ops, Cabin Service and Technical and precludes Ground Ops. The empirical data in chapter 5.2.3 show that TCAS's cabin crew, engineers and especially pilots have extensive training in safety risk management and thus report any errors or concerns when a procedure is altered. The empirical data suggest that as soon as a change in procedure is made, all 225 pilots use and review the newly altered procedure. This ensures that changes receive full attention and any inadvertent outcome of such changes is quickly noticed, reported and corrected. This isn't the case with the Ground Ops department, which the empirical data suggest has more difficulty getting such information due to the outsourcing of the ground handling to external parties. This can also be attributed to the absence of external re-enforcement (LaPorte, 1996) and will be analysed in the upcoming chapter.

6.1.3. AN UNSTABLE EXTERNAL ENVIRONMENT

HROs are often seen as 'rational' in that they have highly formalised structures and are oriented towards the same clear and consistent goals, according to the theoretical framework in chapter 3.4; in addition, HRO performance is highly linked with the extraordinary cooperative behaviour within the organisation itself (LaPorte, 1996). The empirical data support this, as the four departments showed devoted dedication to the safety goals within the organisation and the importance of the MoCs. Although a few hiccups along the way were revealed, the empirical data support that the company turned those failure points into learning, as shown in the previous chapters. TCAS's highly formalised structures regarding how and when a change can be accepted seems to be rooted in both the organisation's safety culture and its desired safety level, as indicated in the empirical chapter. This notion seems to be shared by all the informants in this research, but

especially those informants who have direct contact with such risk assessment on a regular basis. This assertion is supported by the empirical data; for instance, the relatively low threshold of acceptable risks, all employees having the opportunity to stop work due to safety issues and TCAS's routine MoC discussions and exchanges of important information at the various meetings.

However, HROs also need a stable external environment to ensure their internal conditions for reliable performance (LaPorte, 1996). The empirical data indicate that this currently imposes a challenge for TCAS, as the close cooperation and relationship with TCGA have created a drift from a stable external environment towards an unstable external environment. By revealing the consequences of the implemented Q-Pulse system, which was highlighted in chapter 5.2.5, the empirical data indicate that an MoC was conducted on a more general and group-wise level and in sibling companies rather than TCAS itself. This induced a shift, as TCAS now requires more information from external stakeholders than previously and, due to uncertainties in external relations, has encountered a disturbance in the stable internal processes. The external support for achieving the internal conditions now heavily lies with TCGA and its member companies, whereas before it lay with TCAS itself, which controls the external environment. This research suggests that when it comes to flight safety, rather than more administrative changes such as a new IT system, handling agents and the Q-Pulse system, a flight safety goal exists within the departments and TCAS itself. When it comes to flight safety, TCAS displays extraordinary HRO performance. Thus, one can argue that flight safety within TCAS is still considered a non-negotiable and indisputable goal; this can be seen as a partial result of the external relations such as ICAO, EASA, DTCA and TCGA supporting the internal HRO culture towards these assessments and their flight safety goal. However, it seems that TCAS is exposed to other non-official goals within the organisation as such goals are heavily influenced by the outside environment, so the continuously reliable performance within TCAS is difficult to sustain under administrative changes as these changes can be related to the external environment. The absence of external re-enforcement from TCGA to sustain and support the interaction between the internal elements at TCAS and the external environment at TCGA and its members is seen in matters regarding administrative changes. Sagan's (1995) assertion that HROs are seen as relatively 'closed systems' inflicts an unfair notion towards TCAS, as one can argue that TCAS has always dealt with the external environment, for example with ICAO, EASA and DTCA. It is therefore the challenges TCAS faces when dealing with the conditions of upholding and maintaining the re-enforcements of the stable external environment that poses a challenge for the HRO performance.

TCAS displays good control over its own structures, resources and culture within the organisation. However, once other processes and activities linked to TCAS's operations require and involve other organisations, it encounters some challenges. It becomes problematic for TCAS to have the interaction it desires with external

people, it becomes problematic to incorporate the external relations as a part of the organisations methods, and it becomes problematic as the external relations talk differently and have different cultures. Based on the empirical data, TCAS encounters these challenges when it comes into contact with the unsustainable interaction and unstable elements in the external environment. It can be argued that TCAS, and airlines in general, are about to become involved in these network situations and TCAS, as well as the TCGA, must address the challenges arising from this. This is also evident in the empirical data regarding the challenges of the subcontracting of ground handlers, which Ground Ops referred to in chapter 5.2.5. These examples demonstrates how exposed HROs are to changes in their environment and the way they are organised.

6.1.4. INSTITUTIONALISED DEFICIENCIES

With respect to collective mindfulness, chapter 3.4 states that reliable outcomes stem from the result of stable cognition towards the varying processes and performance. According to Weick et al. (1999), this involves a revision of current processes, procedures and problems that is possible only because of the stable processes of understanding, detection, evaluation and revising when new events and information emerge. Based on the previous chapters, to achieve such a state, an organisation requires the imposition of such a requirement by either a legislator or internal agreed-upon work practice. To illustrate this assertion, the two examples of change in handling agents provided by the Ground Ops informants will be used.

According to a Ground Ops informant mentioned in chapter 5.2.5, TCAS changed handling agents in Scandinavia from SAS to Aviator, which was accomplished with a satisfactory result. The theoretical framework highlighted a natural variation in the performance at the workplace, but when organisations exercise collective mindfulness, stability in cognitive processes should exist to make sense of the performance (Weick et al., 1999). This should have enabled TCAS to avoid breeding confidence and fantasy (Starbuck & Milliken, 1988) and a drift towards complacency. However, it can be argued that this was not the case, as TCAS made an MoC in regards to handling agent in the Canary Islands and the MoC pointed out some areas of concern that somehow had been neglected. In this example, complacency appears a possibility as TCAS failed to investigate the mentioned concerns. These adversities resulting from the change could have been avoided or prevented by strong enforcement of the institutionalised practice to review such a change in the SCRB, that is, by employing a strict process which, according to the empirical data, is found when the Flight Ops department conducts risk assessments in relation to new airports. It appears that avoiding behavioural patterns of inertia, where an organisation drifts towards complacency, inattention and habituation, requires an organisation to have and uphold institutionalised practices through enacted procedures or standards to ensure that vital risk assessment and decision-making activities are not neglected.

Slightly in line with the above analysis, a preoccupation with failure also requires maintaining reliable performance, which is considered a system issue (Weick et al., 1999). According to the empirical data, TCAS is aware of its previous history with MoCs and its institutionalised deficiencies. To rectify this, the empirical data show that TCAS has internally agreed upon a procedure, which puts the MoC on every agenda and in every meeting, regardless of whether it is a monthly operations meeting or the bi-monthly SCRB meeting. Over time, this internally agreed-upon procedure is supervised and audited by the quality department to ensure that the MoCs have been performed as agreed and the process is continually developed and improved. This corresponds to the first principle of collective mindfulness, as system issues focus on institutionalised deficiencies rather than blaming the shortcomings of fallible individuals.

6.2. RELUCTANCE TO SIMPLIFY INTERPRETATIONS

As the document analysis in chapter 5.1 illustrates a rather mechanical process, it was necessary to ask the informants questions about how they are involved in the MoC process to uncover any tacit knowledge. According to the theoretical framework described in chapter 3.4.2, too many simplifications are dangerous for HROs, as prescribed assumptions can lead to lack of foresight and precautions that result in a simplified worldview. The empirical findings in chapter 5.3 show that TCAS remains reluctant to simplify its risk assessment activities in relation to MoCs. This subchapter analyses the empirical data based on the theoretical data to explore whether TCAS stays representative of a complex world, how it socialises its organisation to make fewer prescribed assumptions and how it ensures avoiding the normalisation of deviance.

6.2.1. CULTIVATION OF REQUISITE VARIETY

To suppress the temptations to simplify complex working tasks, HROs cultivate requisite variety. Requisite variety is believed to be needed because a complex organisation is needed to sense a complex system. The empirical data show that the composition of the SCAG and the SCRB as well as assurance that these two review boards cover the MoCs on every agenda helps cultivate requisite variety. As several informants said, these review boards help avoid silo thinking, where departmentalised decisions are made independent of the rest of the organisation. Thus, this is thought to help in avoiding homogenous groups of thinkers and doers (Weick et al., 1999). Because different departments can ask questions regarding risk-assessed changes originating from other departments, the empirical data suggest that this can combat 'collective ignorance' (Turner & Pidgeon, 1997), as TCAS decision makers want to question and challenge the different departments' assessment, allowing them to notice more. The strength of TCAS therefore lies especially with the SCRB composition and the activities around it, which can be argued to constitute systematic variety to protect against unwanted variety (Ashby, 1956). Systematic variety at TCAS appears as frequent meetings,

committees such as the SCAG and the SCRB where the MoC is a permanent item on the agenda and the low threshold towards risk, which results in a variety of responses. Unwanted variety at TCAS can, in this context, materialise as unwanted events, which is generated from all the socio-technical possibilities that have not been anticipated, recognised, accounted for or discussed that stem from the lack of systematic variety. According to Perin (1995), such internal complexity can be seen as a criticism of HROs and thus be expressed as a criticism of TCAS. Perin's (1995) criticism resembles the criticism put forward by Perrow (2011), as the more systematic variety in an organisation, the more complex and tightly coupled the processes inherits. However, the empirical data indicate that an initiative such as the treatment of risks in the SCRB to match the system complexities may, in fact, contribute to a more holistic and integrated perspective for the decisions makers. Unfortunately, the empirical data do not suggest whether the contribution is caused by the relatively small organisation, the constellation of the review boards, the insightful knowledge of the SCRB members, the interrelated teamwork, which appears to be present, or any combination thereof.

Requisite variety does not necessarily need to be cultivated within the organisation itself. As an NP informant explained (chapter 5.3.1), TCAS can also learn through the well-known global fix within the aviation industry (Westrum, 1992). The global fix also resembles what Turner and Pidgeon (1997) termed cross-organisational isomorphism, where separate organisations in the same industrial sector deal with identical processes and problems due to the similarity of one organisation's processes and structures to those of others. This makes airlines and TCAS capable of learning from each other and cultivating cross-organisational requisite variety.

Although it is difficult to discuss the effects of TCAS's newly adopted initiatives regarding the assurance of MoCs, a few remarks will nevertheless be given to highlight some of the perceived challenges, which TCAS is thought to be facing. The empirical data indicate that almost all informants agreed that the brainstorming activity, in addition to the SCRB, contributed to creating requisite variety. However, the empirical data also suggest that the foundation upon which the brainstorming process is based is challenged by the lack of properly defined stakeholders when doing administrative MoCs. Even though that the two review boards cultivate requisite variety, it is considered equally important that the collection and preparatory work are also characterised by such cultivation. While one of the Flight Ops informants said that such brainstorming events must not constitute an exclusive club, the empirical data indicate that the prevailing norm is in fact the opposite. One such example is found in the empirical data in chapter 5.3.1, with a Cabin Service informant who is currently reviewing an IT system. This may indicate that a brainstorming event with clearly defined stakeholders is challenged and thus lacks the inclusion of other important stakeholders, which would create an arena for the cultivation of requisite variety and thus strengthen the decisions taken in one of the review boards at a later point. According to Schulman (1993), conceptual slack gives an organisation diverse

analytical perspectives. Ideally, this should be incorporated in both the brainstorming activities and the decision-making process to create and benefit from the best possible outcome of an MoC.

Another important aspect, which is considered important to present here, is the statement from one of the Technical informants. In chapter 5.3.1 the informant explains that "*We are a small organisation and know how it's interconnected. We therefore know exactly the three or four people who will be included in the analysis*". This statement articulates a duality, as it can contain an inherited strength and, at the same time, pose a threat to the organisation. One can argue that the members of a relatively small organisation such as TCAS can establish and maintain an organisational cognitive map of its skills and people. Strength therefore exists where TCAS can sustain an integrated overview of those believed to hold and have the right knowledge. On the other hand, a challenge might threatens the organisation, as members of the SCRB make certain assumptions. These potentially dangerous collective assumptions materialise when SCRB members assume to know, or believe, that the correct people have been identified earlier and therefore are considered sufficient for the brainstorming activities as well as the preparatory work. Such collective assumptions can induce an organisation to preserve its prevailing institutionalised norms and practices, which might make it prone to perceptual rigidities and organisational arrogance (Turner & Pidgeon, 1997). It can thus be considered important for the SCRB not to base its selection of people to enter such brainstorming activities on perceived accustomed capabilities, as this may lead to habituated routines that may be susceptible to prescribed disruptions. Instead, organisations should establish an institutionalised practice, which avoids such habituated routines; this allows for and creates a process for the identification of lesser-known stakeholders within or outside the organisation, who can provide important tacit knowledge for such processes and identify and manage adversities associated with the impending changes.

6.2.2. BEYOND THE SIMPLE VIEW OF RISKS

According to Aven and Krohn (2014), decision makers should go beyond the simple view of risk (see chapters 3.3.1 and 3.4.2), such that judgements are not solely based on simple risk matrices. When decision makers go beyond simple risk matrices, they are reluctant to simplify interpretations as they allow for overall system understanding, a knowledge dimension on which the probability and prediction of potential surprises is based. The empirical findings in chapters 5.2.4, 5.3.4, and 5.4.3 indicate that TCAS includes such a knowledge dimension in its risk decisions. Although TCAS's risk assessment is conducted based on the two-dimensional view (see chapter 5.1.3), it incorporates a knowledge dimension when decisions are to be made. This chapter will explore TCAS's vigilance towards risk-characterised decisions, as its vigilance seems to be divided between flight safety and administrative changes.

The empirical data indicate that TCAS is driven by a strong culture when it comes to flight safety. All informants remarked on, or described, a safety culture where all employees, regardless of hierarchal status, can bring forward any vital information that could compromise safety. The risk-assessed MoCs of new airports demonstrated the strong interaction between the assessors and the SCRB, which takes place at TCAS. The collaboration between the assessors and the quality of the review and assurance in the SCRB generates a positive synergy effect. The example with the MPADS assessment (see chapter 5.2.4) reveals the delicate interaction in which the SCRB members and the employees exchange information. This demonstrates how the knowledge dimension of these assessments moves freely within the organisation before any decision is taken. According to Turner and Pidgeon (1997) , all organisations simplify their tasks, which allows them to ignore data and keep going. This is illustrated by the assessor, in this case one from the Flight Ops department, who prepared a 'mechanical' risk assessment in regards to the two-dimensional view (see chapter 3.3.1). One of the Flight Ops arguments was that it would be too comprehensive and time-consuming to conduct a bow-tie analysis on each of the 86 required items on the risk assessment. A more advanced risk assessment, such as the bow-tie, helps TCAS perform a more in-depth analysis as well as identify proactive and reactive barriers, but it does not replace the crucial exchange of risk characteristics between the assessor and the decision makers, which appears to be present when the Flight Ops assessors stand 'trial'. The empirical data in chapter 5.3.4 indicate that when the assessor has conducted the assessment, he or she hands it over to the SCRB for further discussion and review. This results in the risks being exposed in an open forum in the SCRB, such that all SCRB members, regardless of departmental area, can ask questions about certain risks. Not only does this allow for the divergence of analytical perspectives (see chapter 6.2.1), but it also allows for risk-characterised descriptions, as the SCRB can ask questions or highlight any areas of concern towards why risks were assessed as they were. In the case with the MPADS, the SCRB had doubts about the assessed risk and why it was assessed as acceptable. The decision makers therefore go beyond the simple view of risks and base their decision on the overall risk characterisations; thus, they can be seen as reluctant to simplify their interpretations. The constellation at TCAS and the way employees have institutionalised their risk assessment activities towards new airports indicate that TCAS is capable of noticing more and has thus socialised its SCRB members and assessors to making fewer simple rule-of-thumb assumptions (Xiao et al., 1997), as these assumptions can bring unwanted surprises (Aven & Krohn, 2014). It might be important to emphasise that the interaction between assessors and SCRB members is possible due to several prerequisites at TCAS: highly qualified proficiency among the SCRB members (see chapter 5.2.5), commitment to such risk assessments (see chapter 5.3.4) and the presumed safety culture at TCAS (see chapter 5.3.3). These three prerequisites will be further highlighted hereunder.

First, the prerequisites regarding the highly qualified proficiency among the SCRB members can be attributed to the requirements from the DTCA to keep the NPs up-to-date in their area of expertise in which they also are audited. Second, the prerequisites regarding the commitment to risk assessment in relation to flight safety can be attributed to the keen interest and vigilance which the SCRB displays, as it goes beyond the minimum requirements of the highlighted risks, as indicated in two places in the empirical data: when the assessor needs to further assess and risk-characterise certain risks and when the risk is higher than desired by the SCRB. However, this is also indicated when the assessors are questioned about those risks that have a lower risk score than 6. The SCRB therefore goes beyond its stated responsibilities. Based on the empirical data, for example, the assessor in regards to the MPADS, approved the flight over Afghanistan whereas the SCRB was more reluctant to approve such a risk and thus based the decision on risk characterisation rather than more mechanical risk judgements. Such interest from the SCRB can have a positive effect on the safety culture, which concerns the last prerequisite. The last prerequisite is concerned with the presumed safety culture at TCAS, which can be attributed to what seems to be a shared safety goal of continued flight safety across, and regardless of, departments and TCGA members. At no point during the two-month stay or the data collection did it appear to the researcher that any doubts existed when it came to the safety of aircrafts, their operation or passengers. All informants agreed that if anyone has an issue regarding flight safety, an investigation would be initiated almost instantly. All informants said that safety is the organisation's biggest concern.

While changes with respect to flight safety seem to be the organisation's highest priority, the empirical data indicate that administrative changes such as a new IT system, handling agents or the Q-Pulse system do not have the same priority. Note, however, that such changes can be more difficult to anticipate or revert. For instance, knowledge gained by flying to a new airport can quickly be turned into continuous learning points, which can be reflected, in TCAS's future approach. Such knowledge may stem from diverse sources, including, for example, a training simulator built up around the airport, cross-organisational isomorphism gained knowledge and learning points from repeated take-offs and departures from the given airport. These small amount of data points is considerably harder to obtain when implementing more administrative changes. One can argue that more vigilance towards such risk assessments is therefore required and the compliance with internally agreed-upon procedures is crucial. Although it might be difficult, some changes cannot be discussed openly as they are restricted to the appointed NPs. For example, changes related to mergers have the possibility of increasing or decreasing the market value of the organisation, if such changes become publicly known. Other changes relating to downsizing might also be highly sensitive and capable of inflicting several difficulties.

According to Aven and Krohn (2014), risk should be based on informed characterisations of uncertainties but, at the same time, not abandon the use of professional analysts to avoid an unbalanced decision-making process (see chapter 3.4.3). When the SCRB members seem to have bypassed professional analysts in the risk assessment towards the administrative changes, an imbalance seems to have arisen. The previously mentioned example of the Flight Ops assessor in relation to a new airport is that the assessor stands trial for the prepared risk assessment. These assessors are therefore able, according to Aven and Krohn (2014), to characterise risks and uncertainties and escape the simple view of risks. The imbalance seems to be centred on the assessors within the SCRB group not being able to escape the view of simple risks as they are a part of the decision-making body. The empirical data in chapter 5.3.3 also highlight this issue as several informants expressed concerns regarding the "*sugar coating [of] these MoCs*", "*(…) you may not be completely honest, to make them look good*" as well as "*you can't be political about these assessments (…)*". When the assessor and the decision-making body are intertwined when administrative risk assessment activities are performed, biased judgements are more likely to be formed.

When the SCRB members conduct the administrative risk assessments themselves, they give rise to the possibility of a social negotiation, or the normalisation of deviance. An intrinsic danger, which Aven and Krohn (2014) also highlight in such biased judgements, is the issue of power. The normalisation of deviance and the issue of power will be explored in the following subchapter.

6.2.3. NORMALISATION OF DEVIANCE

Normalisation of deviance is a conceptualisation which Vaughan (1996) constructed based on the analysis of the Challenger launch decision. It refers to the thought that over time organisations increase the acceptable risk criteria, or the risk appetite, due to the social negotiation or social production of risk, which was highlighted in the theoretical framework in chapter 3.4.2. When organisations are reluctant to simplify interpretations, they are reluctant to succumb to the social negotiation of highlighted risks and making such risks acceptable. Normalisation of deviance can therefore support the reluctance to simplify interpretations, as HROs can be said to disallow the possibility of negotiating risks.

The two working routines regarding risk assessment towards new airports and risk assessments towards administrative changes, such as the new IT system, Q-Pulse and handling agents, resemble each other in almost all aspects except one. Whereas a social negotiation is out of the question in relation to flight safety, it appears to be present in some of the administrative changes. However, starting off by discussing the routine towards the risk assessments seems most logical, as it lays the foundation for the seemingly equal process. When an MoC is conducted, whether in regards to flight safety or an administrative change, it is conducted based on various assessments. According to the empirical data in chapter 5.3.1, such assessments

are later treated in the SCAG or the SCRB. As several NP informants pointed out (see chapter 5.3.1), it is important for the SCRB to see which people and how many have conducted the impending change. This produces an assurance for the SCRB, such that it is aware of whether the impending change has been analysed from different angles. Such a constellation and work routine can be characterised as scepticism, where the SCRB preserves awareness of simplifications. According to the theoretical framework in chapter 3.4.2, normalisation of deviance can be suppressed by this unusual type of redundancy. However, the two working routines seem to deviate from each other in the preparatory risk assessment work prior to the decision-making process, which is also partly illustrated in the previous subchapter.

In chapter 5.3.3 a Flight Ops informant, who is also an assessor, explains that the SCRB has never questioned the assessed risk score in relation to flight safety; rather, it has asked questions about why a risk has been assessed as it has been. The informant said that "*if there is doubt, there is no doubt*" and "*We simply do not dare to take the chance*". These statements indicate that a social negotiation is not being performed in the SCRB when it comes to flight safety risks. When the SCRB is unsure of risks or wants to pursue certain changes in regards to flight safety, there seems to be a tacit agreement among the SCRB members that the accessor must stand trial. In such a trial, the assessor(s) can explain and further elaborate on the assessments, but at no time will allow the social negotiation of the assessed risks. However, note that this information came from the same informant that several other informants characterised as a maestro and who brought risk assessment to TCAS before it was made mandatory by regulators. The avoidance of social negotiation in these instances might thus be partly assigned to the impact that the maestro symbolises or represents.

When it comes to more administrative changes, the same reasoning as above cannot be applied. The three examples highlighted throughout the empirical data pertain to the new handling agent in the Canary Islands, the new IT system and the Q-Pulse system and will be explored here in relation to social negotiation. A Ground Ops informant explained (see chapter 5.2.5) that an MoC was conducted prior to the change of a well-established handling agent to another handling agent with a poorer reputational image. According to the informant, the MoC pointed out some areas of concern. Before an audit could take place, a contract was signed and the organisation was able to cut back expenses on the contracts. This example is consistent with the conceptualisation of normalisation of deviance, as there were signals of potential concerns, which then were negotiated and judged acceptable. The next example pertaining to the new IT system is somewhat more difficult to relate to normalisation of deviance, as it is an ongoing and, up until now, undecided assessment. However, the researcher deems it necessary to include it because it can be prone to social negotiation. According to the empirical data (see chapter 5.3.1), one of the NP informants expressed that the person "*slowly groped forward*" with the assessment. The empirical data thus indicate that the stakeholders

identified for that specific change are limited to selected SCRB members. When those few assessors 'grope' forward, it can be argued that they can tend to discuss internally any deviant outcome and be prone to normalise the deviance as an unconsciously agreement and thus unknowingly judge the risks acceptable prior to the official review board in the SCRB. Such a process can be seen as a potential challenge for the legitimacy of the risk assessments.

The last example is in relation to the Q-Pulse system, which was mentioned in chapter 5.2.5. The empirical data do not relate it to whether a social negotiation took place when the change was made. However, the process and the way it was carried out are more indicative of what Antonsen (2009) referred to as one- and two-dimensional views of power. The one-dimensional view of power can be related to the organisational structure to which TCAS must conform due to the hierarchical structure and formal authority that binds the company as a member organisation of TCGA. The one-dimensional view has been criticised for being too mechanical, whereas the two-dimensional view of power also has a more invisible face: the face of non-decisions, which is reflected by withholding potential issues or problems from the decision process (Antonsen, 2009). This is indicated in the empirical data, when one of the informants states that "*an MoC on Q-Pulse was conducted, but we just haven't seen it*" and "b*ut again, now we are up on a high management level and we 'rank-and-file' managers cannot really do anything*". Although the issue of power falls out of the scope of this research, is it an important point to bear in mind when the risk assessment activities regarding MoCs are performed. To circumvent what one NP informant figuratively expressed as "*the fox guarding the hens*", is it necessary that the agreed-upon framework towards the risk assessment in activities relation to an MoC tries to take such power issues into account.

6.3. SENSITIVITY TO OPERATIONS

As outlined in chapter 3.4.3, sensitivity to operations pertains to organisations staying responsive to the messy reality inherent in most socio-technical systems (Weick & Sutcliffe, 2007). The empirical findings in chapter 5.4 show that TCAS stays sensitive to the risk assessment activities in relation to an MoC. This subchapter analyses the empirical data on the basis of the theoretical framework to explore whether TCAS is attentive towards signals or warnings, which at first glance might resemble trivialities, how it maintains shared 'bubbles' and whether it is sensitive towards more subjective risks.

6.3.1. SCRB – EXCHANGE OF SHARED BUBBLES

The empirical data presented in chapter 5.4.1 leave little doubt that the SCRB is the forum for the exchange of shared bubbles. The analysis so far has highlighted that the SCRB members are fierce advocates within their area of expertise. Through the SCRB, they are both allowed to and want to share information and ask question they consider important. One of the Technical informants said that a strength of TCAS is that the

company is *"(…) a small organisation and we know each other. We know how it all is 'screwed' together"*. Although this statement might have been paronomastic, it nonetheless serves as what Weick et al. (1999) termed 'situational awareness' and what constitutes, when a complex socio-technical system has created and is able to maintain, a network of bubbles. When TCAS employees know how the organisation is put together, they can uphold a cognitive map allowing them to sense an integrated big image of the operations (Rochlin, 1997). To avoid what Miller and Woods (1997) termed automation surprises, TCAS utilises a risk register in addition to the MoC which allows the SCRB to stay alert and catch errors in the moment of weak signals and warnings.

One of the SCRB remedies for upholding the network of bubbles can be attributed to its internal risk register, referred to in the empirical data in chapter 5.4. Both the risk register and the SCRB function as the main hub, where TCAS generates an overview of all risks which are threatening either the organisation or individual departments. The empirical data indicate that whenever a person brings forward a concern which hasn't yet been fully explored, it must be listed in the risk register and a preliminary risk assessment must be conducted to identify the responsible department and person for the specific risk. TCAS, through the risk register and the SCRB, should thus be able to perceive the elements in the environment and quickly can seek the right answer while diminishing the occurrence of automation surprises. The empirical data suggest that a low threshold exists for when a risk can be brought forward and that anyone can bring forward these risks. The empirical data also suggest that TCAS stays sensitive to those risks which don't necessarily threaten one department, but could threaten other departments. The risk register is brought up in every review board, where new and old threats, and whether those threats require an MoC, are discussed. Once again, this initiative indicates an organisation capable of exchanging information regardless of horizontal departments and vertical hierarchies within the organisation and thus helps to create a forum where a network of bubbles can thrive. Even though many threats can arise in-between these bi-monthly review board meetings, the empirical data also indicate that, due to the relatively small organisation, several of the SCRB members meet up during the day to briefly exchange information. This may point to TCAS's ability to stay sensitive to allocating sufficient time for information to be exchanged freely within the organisation.

Controversially, according to the empirical data in chapter 5.4,1, most of the informants expressed strong feelings towards keeping the risk register open for any impending and mitigated MoCs. This type of transparency would create a more open organisation, which could benefit the safety culture and keep the SCRB current on impending MoCs. At the same time, the informants highlighted the inherent danger of making high risks openly available, as doing so might generate unrest in the organisation. Although regarded as a double-edged sword, this could, in fact, contribute to the challenges that several of the informants

mentioned throughout this research. Such examples include the Canary Islands incident with the change of handling agent as well as the statement from an NP informant concerning the "*fox guarding the hens*".

Equivocality exists regarding how far-reaching the understanding of SRM within the organisation should be. On one hand, it seems sufficient if the assessors closest to the SCRB and the SCRB members themselves have profoundly knowledge and are confident regarding the SRM, while keeping the rest of the employees in the loop and maintaining adequate knowledge. Hereby, employees know and understand their role and contribution or, as one informant termed it, they know that they are part of a bigger puzzle. On the other hand, too much restriction might result in a closed and exclusive group, which challenges the organisation in uncovering tacit knowledge and safeguarding its activities.

6.3.2. SENSITIVE TO SUBJECTIVE RISKS

The theoretical framework described in chapter 3.4.3 highlights that the quantitative approach in technological organisations poses a threat for HROs, as both a quantitative and a qualitative approach is judged important. The empirical data in chapter 5.4.3 suggest that TCAS favours both approaches. The empirical data indicate that TCAS is mindful of the difficulties of placing certain risks in a box system, due, for example, to low statistical background knowledge or because the risk relates to qualitative judgements. What TCAS seems to have done is allow for these diverse meanings and set up meetings where more informative characteristics of the risk and uncertainty can be exchanged and shared, as was also mentioned in chapter 6.2.2. One informant (see chapter 5.4.3) explained that "*(…) if we are discussing it based on the box system where you have the red, yellow and green, then one can most often without valuing them and actually argue, from this perspective and that perspective, that a risk should be put here or there*". This statement is indicative of what Aven and Krohn (2014) determine to be more informative characteristics of risk and uncertainty while not abandoning the need for value judgements by relevant persons, as described in chapter 3.4.3. Even though the Technical department appeared to favour the more quantitative approach, its employees quite often experienced different assessments internally in the department due to individual knowledge and experiences. This also required employees to set up meetings to exchange the informative characteristics of risks and uncertainties.

The empirical data also indicate that the SCRB stays sensitive to a qualitative approach towards the assessed risk. The example of the MPADS highlighted in chapter 5.4.3 indicates that even though the risk assessment indicated it was safe to fly over Afghanistan, some subjective concerns arose within the SCRB regarding public relations and customer experiences. This is also indicative of the more informative characteristics of certain risks.

6.3.3. MANAGEMENT OF CHANGES – AN AUDITED PROCESS

Although this subchapter is closely related to collective mindfulness in general rather than to the third principle specifically, it has been included here because lines can be drawn between this subchapter and sensitivity to operations. The theoretical framework described in chapter 3.4.3 explains that HROs are more aware of the tension between safety and productivity to ensure sensitivity to operations. The empirical data in 5.3.1 show that an informant expresses a tendency to skip a brainstorming event due to the easy shortcut of quickly defining accustomed assessors as they are believed to do the job satisfactorily. This is a core example of an organisation tending to drift towards cutting away what is believed to be superfluous redundancy. The peculiar finding in this research is that while TCAS is aware of such tendency and possible drift, it has implemented a rather ordinary and well-tested approach within the aviation industry to ensure sensitivity. By resorting to making the MoC an internally agreed-upon procedure, it can audit the process over time. TCAS is, therefore, forced to stay alert and mindful as it is conscious of the pressures with which it deals. The statement from one of the Flight Ops informants in chapter 5.4.2 supports this assertion. Even though the regulators demanding a risk assessment in relation to an MoC has helped, it is only really useful if a driving force is behind it. Such a driving force can be associated with an agreed-upon auditable standard or process towards such risk assessments, which the company needs to uphold and comply with internally or externally.

The empirical data in chapter 5.4.2 also suggest that the informants are convinced that a routine methodology forces them to think about such matters if doing so does not come up naturally. However, such a routine methodology must not be too rigid, as the SCRB and the assessors must have enough room to go beyond the agreed-upon process if deemed necessary. This is indicated, in chapter 5.3.2, if TCAS were to acquire new aircrafts. In such a case, an MoC is most probably guiding the risk assessment, resulting in several larger risk assessments with many diverse meetings. Consistent with collective mindfulness and the avoidance of fixation failures, an auditable routine methodology for risk assessments in relation to MoCs can contribute to the organisation's sensitivity to operations. However, the tools in the risk assessment must go beyond a static and standardised approach to avoid the aforementioned fixation failures. When such a routine is embodied in the organisation over time, it might result in the employees thinking about the process and the risk assessment subconsciously. This seems to have happened with the risk assessments towards new airports, which was implemented more than 11 years ago and is now considered irreplaceable, at least by the Flight Ops department.

6.4. RISK ASSESSMENTS' CONTRIBUTION TO ORGANISATIONAL PRECURSOR RESILIENCE

The three previous subchapters have highlighted how TCAS is collective mindful in its risk assessment activities in relation to a management of change and how this is reflected throughout the organisation. This subchapter summarises the above findings and answers the research question by analysing the risk assessment in relation to an MoC at TCAS pertaining to the anticipatory principles of collective mindfulness and how they relate to characteristics of organisational precursor resilience. This subchapter therefore seeks to answer the main research question:

> *How does the use of risk assessments in relation to a management of change at Thomas Cook Airlines Scandinavia contribute to organisational precursor resilience?*

The theoretical framework sees resilient organisations as organisations capable of and able to "*recognise, adapt to and absorb variations, changes, disturbances, disruptions, and surprises*" (Hollnagel et al., 2006, p. 3); the resilient organisation "*scans its environment, monitors impending changes, and rolls with the punches. A true mark of resilience is thus the ability to negotiate flux without succumbing to it*" (Comfort et al., 2014, p. 8). This allows us to venture down the organisational precursor resiliency path based on the above analysis of the operationalised anticipatory principles.

While TCAS has institutionalised a relatively low threshold towards risk (see chapter 6.1.2), it has stayed up-to-date and monitored changes before they are set to happen and discussed adversities, if any, that such changes might entail. The lower the threshold towards risk that TCAS has, the more it negotiates and monitors. However, at the same time, more constraints are inflicted on the SCRB members as they need to relate to and discuss more topics. Based on the previous analysis, it appears that TCAS benefits from the low threshold towards risk, such that it is forced to scan its environment. Such an initiative must be considered an important organisational activity that helps TCAS operate in a precursor resilient zone. Because TCAS, in these diverse review boards, allows employees to discuss the relevancy of upcoming changes, it offers a place where employees seem to be capable of recognising more potential problems and sorting out trivialities from more threatening problems. Such an initiative suggests an organisation that is able to monitor and negotiate both impending change and unforeseen or unanticipated adversities before they materialise. These MoCs seem to help SCRB members recognise more potential problems and thus enable the organisation to adapt to and absorb changes and potential adversities stemming from changes.

Because risk assessments in relation to MoCs with a risk score of 6 are sent directly to the SCRB, the MoC can be discussed and judged widely throughout the organisation, as several departments with diverse experiences and expertise are represented at SCRB meetings. Having these diverse SCRB members allowed,

wanted and expected to question both the actual risk assessment and the risk assessment process seems to breed several characteristics of organisational precursor resilience. One of these characteristics pertains to the SCRB members staying sceptical towards the actual risk assessment process, which allows them to discuss and recognise whether the possibility of disturbances and surprises can be caused by the lack of a satisfactorily and thoroughly prepared risk assessment in relation to an MoC and thus avoid succumbing to flux and the inability to accommodate change. Another characteristic of precursor resilience can be found when the SCRB is forced to discuss risks of potential changes across departments, where the SCRB members are encouraged to engage in the requisite variety and thus increase the chances of avoiding departmentalised decisions. Regardless of whether a change pertains to new procedures, aircraft, handling agents or airports, not only can the originating department recognise adversities and benefits from such a change, but other department can pitch in and question whether such a pending change can spread any adversities to other departments. These MoCs seem to be capable of enhancing precursor resilient characteristics rather than creating them. As mentioned, these review boards need to cultivate the requisite variety (see chapter 6.2.1), which can be seen as a characteristic of organisational precursor resilience, as such information exchange in these review boards allows all departments within TCAS to scan the environment and monitor impending changes. When all these departments engage in organisational activities, appearing at TCAS as frequent meetings, committees such as the SCAG and the SCRB where the MoC is a permanent item on the agenda as well as the low threshold towards risk, a variety of responses that seems to contribute to requisite variety and suppresses silo thinking where departmentalised decisions are to be made. Thus, one can argue that risk assessment in relation to an MoC can increase requisite variety within the organisation, as employees are forced to discuss upcoming changes caused by the MoCs. The analysis revealed that the diverse analytical perspectives (Schulman, 1993) are relatively restricted to the SCRB members when performing risk assessments in relation to administrative MoCs (see chapter 6.2.1). One can argue that the process leading up to the decision-making should likewise be influenced by such diverse analytical perspectives in the MoCs; this might contribute even more to requisite variety and thus increase characteristics of precursor resilience, as TCAS should be capable of recognising and adapting to more variations and changes within the organisation and thereby enhance its ability to accommodate change with the possibility of fewer adversities.

One challenge TCAS could have been exposed to, but seems to have produced an organisational capacity to protect against, is that MoCs most likely will be discussed across departments. The analysis revealed that if an MoC were to be discussed internally in a department, it could result in a homogenous group of thinkers and doers, as the NPs need to have a specific background to function as an NP (see chapter 6.1.2). By ensuring that departmentalised decisions can't be taken towards major changes without consulting the rest of the organisation, TCAS has demonstrated an organisational capacity to protect against the potential for

operational disruptions (Macrae, 2014) caused by departmentalised changes migrating and influencing other departments.

The analysis revealed that TCAS demonstrates extraordinary cooperative behaviour towards both MoCs originating within TCAS itself and changes affecting flight safety (see chapter 6.1.3). TCAS can be considered 'rational' (Sagan, 1995), as it has highly formalised structures and is oriented towards the same clear and consistent goals, with one of these goals pertaining to flight safety. When the organisation displays good control of its internal structures, resources and culture, it can implement safety measures that are widely accepted throughout the organisation, as little effort is needed to convince that such precautionary measures are valuable. An example of this is found when all informants expressed appreciation towards an institutionalised practice, ensuring that the MoC and the organisational activities related to it are mandatory agenda items in every meeting. However, the analysis also revealed that TCAS depends on a stable environment to ensure its internal conditions for reliable performance when conducting these MoCs (see chapter 6.1.3). The external relations with TCGA and its members as well as the outsourcing of ground handlers seems to challenge TCAS, as some administrative changes lie outside the realm of TCAS's influence. The example of the Q-Pulse system demonstrates that all the internally established structures at TCAS appear to be circumvented, as all TCAS's organisational activities ensuring requisite variety, the cross-departmental decision-making process and the assessor standing trial appear to be bypassed. The absence of external re-enforcement to support TCAS's internal HRO performance challenges the characteristics of organisational precursor resilience related to these MoCs. Limited interaction with external people, challenges associated with incorporating external relations as part of the organisation's methods and the cultural challenges from these external relations seem to restrict certain areas of TCAS's organisational activities related to MoCs and, thus, decrease the possibility of maintaining characteristics pertaining to precursor resilience. However, a question emerges with these external relations: Can these soon-to-be network situations be managed at TCAS and at the group level by forcing employees to adhere to a widespread, group-level agreed-upon work routine. It can be suggested, that risk assessment in relation to an MoC can be seen as a tool to facilitate working with TCAS's external relations to discuss the cultural differences in the TCGA, whether work routine towards the MoCs or lessons from these MoCs, and thus can increase the capability to foster requisite variety in a cross-organisational isomorphism setting and nurture external relations so that the external group members understand their actions are re-enforced in upholding the stable internal HRO performance at TCAS.

When decision-makers go beyond the simple view of risks in relation to an MoC (see chapter 6.2.2), as seen when a Flight Ops assessor needs to stand trial for his or her assessed risks, it allows for overall system

understanding and a knowledge dimension on which the probability is based. The strong interaction between the Flight Ops assessor and the SCRB regarding these MoCs is believed to increase the possibility of negotiating and characterising flux and thus allow for a good foundation for precursor resilience. However, the analysis also attributed some of the strong interaction between the Flight Ops assessor and the SCRB to prerequisites at TCAS, including the highly qualified proficiency among the SCRB members, commitment to such risk assessments and the presumed safety culture at TCAS. The contribution of such risk assessments in relation to MoCs must therefore not be isolated to characteristics of precursor resilience, but should be seen as a contributory factor that is made possible from, at least, these prerequisites. The analysis revealed that when new airports have been assessed, the risk analysis will likely be sent to the SCRB for a final review, where also subjectivities are given weight by the SCRB members (see chapter 6.3.2). The diverse SCRB members can thus thoroughly review and ask any question related to the outcome of these MoCs, regardless of whether they are of a quantitative or qualitative entity, and therefore reveal certain concerns which otherwise may have been judged acceptable based on a more mechanical perspective. Staying sensitive to subjective risk in the risk assessment in relation to an MoC can thus be seen as a contribution to characteristics of precursor resilience because it allows for even more diverse analytical perspectives, opinions and concerns to be expressed. One can also argue that it allows adversities, such as disturbances, disruptions and surprises stemming from such pending changes, to be recognised, monitored and negotiated.

Related to the above finding, when the Flight Ops department uses what can be characterised as professional analysts (see chapter 6.2.2), the decision-making body and the professional assessor do not get mixed up in the MoCs and increase the possibility of negotiating flux rather than succumbing to it. This also leads to the findings that a social negotiation is not feasible. When professional analysts are separated from the decision-making body at TCAS (see chapter 6.2.3), the organisation disallows the possibility of a social negotiation of risks in the MoCs. One can therefore argue that they stay attentive to variations, disturbances, variations and disruptions, which is believed to increase characteristics of organisational precursor resilience. However, again, such a finding must be seen with at least the three earlier mentioned prerequisites at TCAS.

One of the remedies identified for upholding a network of shared bubbles was related to the risk register (see chapter 6.3.1). The risk register is TCAS's main tool when new and old risks are identified; it allows the SCRB to stay sensitive towards risks and upcoming MoCs regardless of department. The risk assessment in relation to an MoC does not as such contribute to creating a network of shared bubbles; instead, it allows the network of shared bubbles to be attentive towards future changes and, most importantly, ensures that such changes are discussed and judged in the SCRB. When these risk assessment in relation to an MoC are discussed in the SCRB and spread among the different departments, it foster attentiveness towards potential

signals of disturbance. Risk assessment in relation to an MoC thus contributes to the possibility of a network of shared bubbles which in turn allows the organisation to recognise adversity and monitor it. This can be seen as a characteristic of organisational precursor resilience.

One finding which appears to contribute to organisational precursor resilience, but is not caused by any of the three anticipatory principles, is related to the internally agreed upon working procedure at TCAS, which have been institutionalised as practice at TCAS to ensure that risk assessments in relation to MoCs and the consecutive decision-making processes are not neglected (see chapters 6.1.4 and 6.3.3). Such an initiative is indicative of what Macrae (2014) termed organisational safety (see chapter 3.3.3) as TCAS has imposed a work routine which seems to functions at all times and, through the internally agreed standard, appears to be activated when needed. The HRO literature seems to favour the self-enforcing nature of HROs to consistently re-enforce the stable cognition towards the varying processes (see chapter 3.4.1), whereas the analysis seems to support the notion of upholding and enforcing an institutionalised practice which requires TCAS to negotiate flux rather than trust in the goodwill of self-enforcing stability in its cognitive processes. This working method may contribute to characteristics of organisational precursor resilience as it structures TCAS through the outlined organisational activities. The researcher does not see this as a shortcoming to the organisational culture or the organisational activities at TCAS; rather, the researcher sees it as a contributory initiative where TCAS has acknowledged the possibility of slips in ensuring the stable cognitive processes and, thus, has safeguarded its organisational activities to remember and uphold stable cognition. Such a precautionary measure can be seen as a risk-resilient behaviour because "the *organisational capacity to protect against the potential for operational disruptions*" (Macrae, 2014, p. 75) has been ensured towards these MoCs because of the internally agreed upon standards.

It does not seem so straightforward to answer explicitly the problem addressed in chapter 1.3. Based on this research, risk assessment in relation to an MoC at TCAS appears to do very little independently to contribute to organisational precursor resilience. However, *co-dependently*, it seems that risk assessment in relation to an MoC at TCAS can contribute and enhance some aspects pertaining to characteristics of organisational precursor resilience with all the above outlined organisational activities in place. For example, risk assessment in relation to an MoC creates an organisational setting in which the different departments can question the conducted assessment because the company has institutionalised a relatively low threshold towards risks or the ability of a Flight Ops assessor to stand trial and characterise certain risks. These organisational settings, or organisational activities, were created and fostered long before the rise of risk assessment in relation to an MoC. However, what the risk assessment in relation to an MoC contributes is the ability to enhance certain characteristics pertaining to precursor resilience at TCAS, which is seen in the

above analysis. When TCAS has institutionalised a practice in which these types of risk assessment can reach the SCRB level, the MoCs can be negotiated and discussed across, and regardless of, departments. This can be considered a precursor resilient-enhanced characteristic, as these types of risk assessment enable the possibility of enhancing the already present requisite variety in both the risk assessment process and the SCRB decision-making process.

Risk assessments in relation to an MoC can therefore be considered vessels for allowing an organisation to achieve enhanced organisational characteristics that resemble organisational precursor resilience, but they do not guarantee this. If organisations presume that only creating a fine document with the title 'Risk assessment in relation to an MoC' assures safety, they have most likely failed. For risk assessment to fully contribute to organisational precursor resilience, a network of safety defensive practices must protect the organisational activities (Macrae, 2014). Such a network of safety defensive practices pertains in this research to at least all the outlined organisational activities revolving around the risk assessment in relation to an MoC that has been created and fostered. These types of risk assessments must therefore be put into a much larger organisational context, such that organisations do not only rely on the conducted risk assessments, but rather the entire organisational setting, which is essential for acquiring organisational safety and allows the organisation to operate in a precursor resilient zone. An important finding here is that TCAS with its internally agreed upon standard ensures that most, if not all, these organisational activities are activated when the risk assessment in relation to an MoC is conducted. Although this initiative is not caused by any of the three anticipatory principles of collective mindfulness in itself, it nonetheless contributes to risk-resilient behaviour (Macrae, 2014), as TCAS has ensured its organisational capacity to protect against potential operational disruptions in its risk assessment activities in relation to MoCs. These final remarks re-emphasise that the anticipatory principles of collective mindfulness only serve as one measure of precursor resilience.

CONCLUSION

"Be prepared to be unprepared."

– Karl E. Weick in (Hollnagel, 2011, p. XXVIII)

7. CONCLUSION

This research set out to answer the research question "*How does the use of risk assessments in relation to a management of change at Thomas Cook Airlines Scandinavia contribute to organisational precursor resilience*"?

Firstly, with the help from the first subsidiary question, this research has exposed some characteristics pertaining to organisational precursor resilience and sought to establish how this type of organisational resilience can be related to the anticipatory principles from collective mindfulness. Secondly, with the help from the second subsidiary question, this research outlined TCAS's risk assessment activities in relation to a MoC and how these activities was representative of the anticipatory principles of collective mindfulness. Based on these two subsidiary questions, the researcher was able to investigate the main research question. This was achieved by analysing the risk assessment activities in relation to a MoC at TCAS pertaining to the anticipatory principles and how they were related to characteristics of organisational precursor resilience.

Based on the diverse theoretical contributions in the theoretical framework in chapter 3, the thorough account of the methodological choices used in this research in chapter 4, the presentation of the empirical data in chapter 5 as well as the analysis in chapter 6, a solid foundation has been established on which the subsidiary questions as well as the main research question have been answered satisfactory.

Based on the analysis of how TCAS are collective mindful in their risk assessment activities, this research found that risk assessments in relation to a MoC contributes to characteristics pertaining to organisational precursor resilience at TCAS. However, for such risk assessments to contribute to precursor resilience, requires an organisation to have established certain organisational activities supporting the notion of these types of risk assessments, such as: the review boards, the relatively low threshold towards risks (which enables risk to be characterised and discussed openly), the commitment from the management to these risk assessments, the presumed safety culture and the highly qualified proficiency among the SCRB members. These organisational activities and prerequisites should not be seen as complete, but as a fragment of both more visible activities and invisible attitudes within the organisation.

As the current established link between the anticipatory principles and precursor resilience is merely conjectural, more research is needed to either establish a stronger link or find alternative models for capturing the notion of precursor resilience. However, it appears that the anticipatory principles contributes to organisational precursor resilience, it must be remembered, that these principles are only one measure to maintain a precursor resilient organisation. This must also be taken into account when this research revealed some challenges related to the external environment at TCAS. These MoCs should only be seen as a small

contribution to the whole safety management setup in place and these identified challenges may therefore not be reflected by other safety risk management approaches within TCAS.

It was necessary to understand the context or the social setting in which these types of risk assessment unfolds. According to Turner and Pidgeon (1997), disasters, and hence risk management, can only be fully understood if they are placed in the social setting from which they emerge and thus where these organisational activities have an effect. Where the analysis revealed that the internally agreed-upon standard, which have been institutionalised as practice at TCAS to ensure that risk assessments in relation to MoCs and the consecutive decision-making processes are not neglected demonstrates how TCAS have established a safety practice. This safety practice is performed on tested and proven practice (Macrae, 2014), as TCAS can be said to be fairly accustomed to working under a strict detailed framework. Such safety practices may thus not be appropriate for other industries that rarely work under such strict conditions. The social setting within an organisation must therefore be taken into account when relating any type of organisational characteristics and processes to precursor resilient performance.

However, no organisation can be deemed risk free and organisations within the aviation industry are often compared to, or associated with, HROs. What constitute a precursor resilient organisation in the literature are ongoing, and perhaps, a never-ending discussion. One thing is sure, resilient-enhanced performance does not come easily to organisations, but it is a result of hard, ruthless and persistent work. No doubt that this poses a challenge for safety risk professionals, as the institutionalised practice towards risk management is thus considered an interminable process, where the organisational activities must be enforced over and over again, for organisations to remain and operate in a precursor resilient zone.

7.1. FURTHER RESEARCH

This last subchapter addresses some possible areas, which could be interesting for further research. As the concept of organisational resilience is an emergent concept within safety science there seems to be plentiful of roads that could have shaped this research differently. Aside from different approaches towards a theoretical framework, this research seems to only having scratched the surface of precursor resilience. It could also be interesting to broaden the concept of organisational resilience, to focus on how organisations perceive and give weight to the relationship between precursor resilience and recovery resilience.

This research could have been strengthening by including TCGA and all of its members in this research. This would have included a better understanding of the relationship and the perceived challenges across this network organisation and to address the perceived challenges with the external environment. These network organisations seems to be something many airlines will run into, or succumb to, in the upcoming years. It would therefore be interesting to investigate the impact these network organisations have on the HRO performance as well as the effect it infuses on precursor resilience.

Risk assessments' in relation to MoCs is only a small element in a much broader risk management scheme within an airline. Many other important elements exist, such as the safety culture, the SMS and risk assessment in general. These elements should not be forgotten, but has been sorted out due to deliberately delimitations. These elements thus give rise for further research to assess how they contribute to precursor resilience.

Lastly, this research has mostly focused on the organisational activities which have been present at TCAS expressed by the informants, but has not accounted for how these activities plays out in the organisational setting. It could therefore be interesting to employ a field study to investigate how the assessment activities in the brainstorming actual plays out as well as the decision-making activities in relation to these MoCs and thus generate characteristics pertaining to precursor resilience from an ethnographic point of view.

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9. APPENDICES

9.1. APPENDIX A – TCGA RISK MATRIX

TCGA Risk and Defence Evaluation Matrix

EVENT RISK — If the event had escalated into an accident, what would have been the worst credible outcome?

What was the effectiveness of the remaining defences between this event and the most credible accident scenario?

	Effective	Mostly	Partially	Min Effective	Ineffective
	numerous effective defences prevented the outcome	few defences failed, a considerable safety margin exists	some defences still in place with remaining defences only partially effective	single defence prevented the outcome	pure luck or exceptional skill prevented the outcome

PROACTIVE — What would be the worst credible outcome?

Probability

	Almost inconceivable that the event will occur <10E-9	very unlikely to occur (not known to have occurred) 10E-7 - 10E-9	Unlikely to occur, but possible (has occured rarely) 10E-5 - 10E-7	likely to occur sometimes (has occured infrequently) 10E-3 - 10E-5	Likely to occur many times (has occured frequently) 1- 10E-3
	Extremly - Improbable	Improbable	Remote	Occasional	Frequent
	1	2	3	4	5

Severity

Severity	People	Property	Operations	Environment	Media	Reputation	N	1	2	3	4	5
Negligible	No health effect/ Injury	No damage	No damage / Little consequence	No Impact	No attention	No Impact	1	1	2	3	4	5
Minor	Minor health effect/ Injury/ First Aid	No evident damage	No evident damage / minor operational influence / use of emergency procedures	No Impact	No attention	No Impact	2	2	4	6	8	10
Major	Major health effect/ Injury	Local damage/ Technical delay	Longer operational disruptions/ Financial loss/ significant reduction in safety margins / NAA restrictions due to non compliance	Some Impact	Local attention	Local Impact / Pax refuse to fly	3	3	6	9	12	15
Hazardous	Disability/ Severe injuries	Major damage	Major operational disruptions/ Missed trips	Major Impact	National attention	National Impact/ Airline reputation compromised	4	4	8	12	16	20
Catastrophic	Multiple fatalities / Loss of life	Loss of aircraft /Equipment destroyed	Removal of certificate of airline/ aircraft	Extreme Impact	International attention	International Impact/ Airline group reputation compromised	5	5	10	15	20	25

Risk Level Definitions % >>

Low 1-5	Medium 6-12	High 15-25

Exposure To Risk +/- 3 (used by Safety Department only)

9.2. APPENDIX B – TCGA SAFETY RISK REGISTER

Figure 9 – Risk Register (TCAS, 2013)

9.3. APPENDIX C – WORKFLOW RISK ASSESSMENT OF MANAGEMENT OF CHANGE
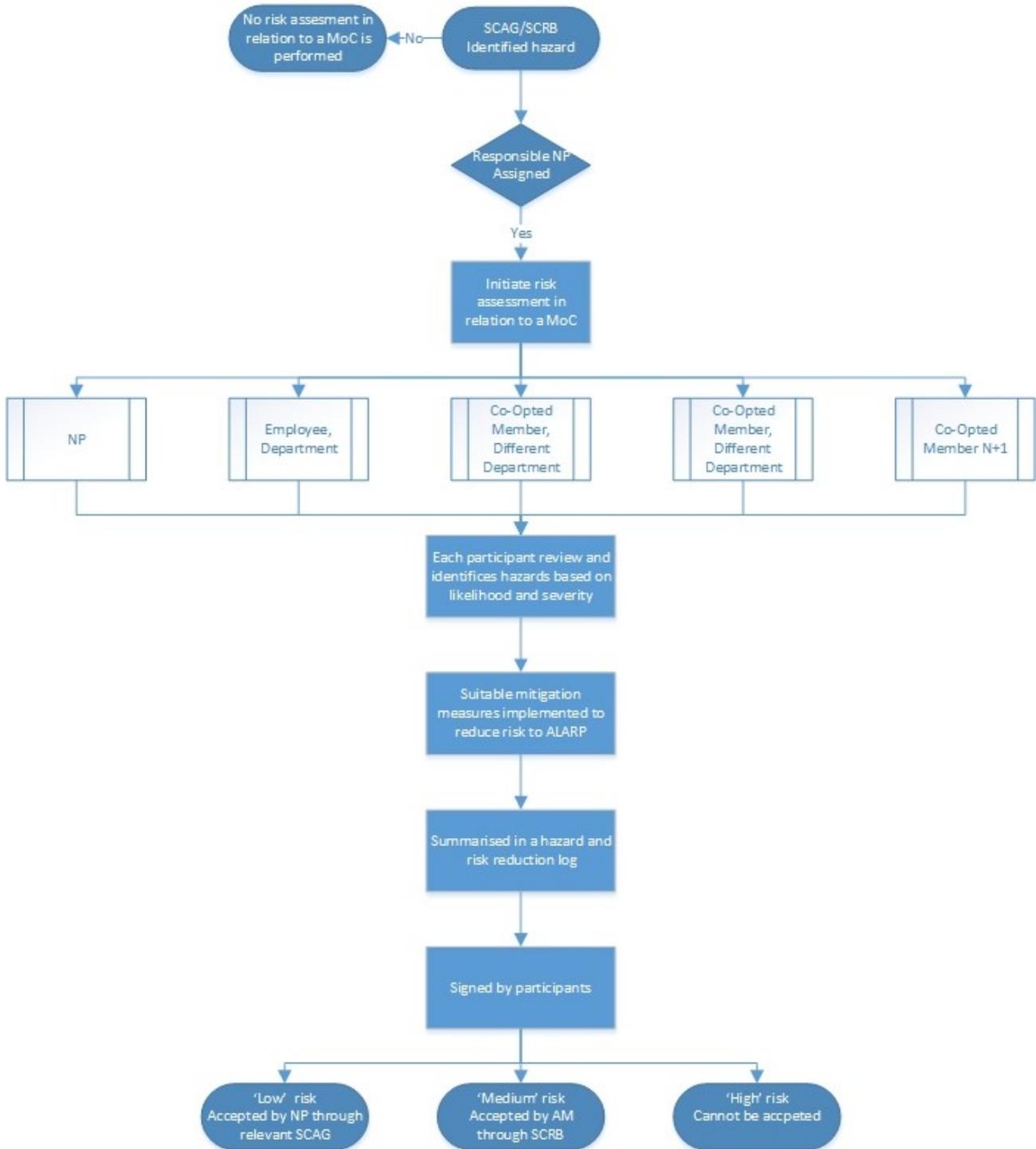
9.4. APPENDIX D – SEMI-STRUCTURED INTERVIEW GUIDE

Interviewguide – TCAS

1

INFORMANTEN

Hvordan er dit kendskab og erfaring med risikoanalyser?	

KONTEKSTEN

1. Kan du beskrive med dine egne ord, hvordan TCAS risikoanalyse i relation til en MoC udføres? Gerne beskriv hele processen fra start til slut.
   a. Hvilke ting ved risikoanalyseprocessen fungerer godt og hvorfor?
   b. Hvilke ting ved risikoanalysen fungerer godt og hvorfor?
   c. Hvilke udfordringer har i og hvorfor?

2. Hvad er formålet med udarbejdelsen af risikoanalyser? (Hvordan mener du de er brugbare)

3. Når I har udarbejdet en risikoanalyse, hvad bruger i den så til?
   a. Hvordan følger i op på den og de udfald der fremkommer?

PREOCCUPATION WITH FAILURE

4. Hvordan arbejder I proaktivt med at finde uønskede hændelser i organisationen?
   a. Ud fra procedurer? Rutiner? Andre forhold?

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5. Hvordan arbejder i målrettet med motivering til at arbejde med risikoanalyser?

6. Hvordan involverer i relevante personer i risikoanalyserne?

7. Har i oplevet at en risikoanalyse ikke var tilstrækkelig?
   a. Hvis ja, på hvilken måde og hvad gjorde i så?

8. På hvilke områder anvendes risikoanalyser oftest i organisationen? Er der områder hvor risikoanalyser ikke anvendes ligeså ofte og hvorfor?
   a. Hvordan italesættes risici og fejl i organisationen?
   b. Hvilke tiltag bliver der gjort, for at afdække eller afhjælpe fejl og risici?

9. Lærer i gennem de risikoanalyser i laver? Hvad lærer i? Hvordan lærer i?

10. Har risikoanalyser haft en positiv og proaktiv effekt, hvorved i har opdaget mulige problemer eller risici ved en ændring?
    a. Har det gjort at ændringen blev mere gnidningsfri?

    b. Har en risikoanalyse hindret jer i fx nyt udstyr, ny rute, en ændring eller lignende?

11. Har i, eller har i haft, udfordringer med udarbejdelse af risikoanalyserne i relation til MoC? Og eventuelt hvilke?
    a. Hvad gør i (eller har gjort) for at komme disse til livs?

12. Hvad er det i risikoanalyserne eller risikoanalyseprocessen, som bidrager til organisatorisk sikkerhed? (Er det udfaldet af analysen, processen? Andre faktorer?)

RELUCTANCE TO SIMPLIFY

13. Ifølge teorien, er forenklinger nødvendig. Men forenkler en for meget, fører det til, at man overser ting:
    a. Anvendes primært Risiko og Sårbarheds-analyser eller bruges også andre værktøjer? Fx konsekvensanalyse, bow-tie, hazop, etc?
    b. Er der scenarier hvor risikoanalyser i relation til MoC ikke mulige eller lidt brugbare? Hvis ja, hvordan håndterer i dette?
    c. Er I bundet af den template der er udarbejdet for risikoanalyser i relation til MoC?
    d. Prøver i at standardisere eller forenkle risikoanalyseprocessen og i hvilken grad? Hvordan påvirker dette risikoanalysen samt processen?

14. Søger i efter enighed/konsensus i risikoanalyserne eller mangfoldige analyser og hvordan påvirker dette risikoanalyserne?

15. Er risikoanalyserne rutinepræget?
    e. Hvordan arbejder i aktivt for, at dette ikke skal blive rutinepræget?
    f. Hvordan sikrer i tid og ressourcer?

16. Hvilke faktorer mener du, bidrager positivt til risikoanalyser?
    g. Både indholdsmæssigt, men også eksterne faktorer og påvirkninger?

17. Hvordan sikrer i kvaliteten af udfærdigede risikoanalyserne?
    h. Gennem komiteer, opdateringer af risikoanalyserne, træning, møder, andet?

SENSITIVITY TO OPERATIONS

18. Hvilken rolle har risikoanalyser i organisationen i forhold til robustheden og paratheden?

19. Hvad bidrager risikoanalyserne til i organisationen i forhold til robustheden (og paratheden)?

20. (Kun hos ledere) Tror du, at ansatte forstår risikoanalysens rolle og bidrag til organisationens sikkerhed?

21. Hvornår udfører i risikoanalyser?

a. Hvornår vælger du/afdelingen/organisationen at indlede en risikoanalyse
b. Opfordres de ansatte eller ledelsen til at udarbejde med risikoanalyser?
22. Er der foranstaltninger der gør, at i husker at udføre risikoanalyser? (Hvordan sikrer I, at være opmærksomme på at udføre risikoanalyser?)
c. Hvilke faktorer eller forhold mener du skal være til stede, for at risikoanalyser skal påbegyndes?
23. Hvilke faktorer mener du, er med til at fremme en risikoanalyseproces?
a. Hvilke faktorer mener du, er med til at fremme en risikoanalysedokumentet?
24. Hvilke faktorer mener du, er med til at hæmme en risikoanalyseproces?
a. Hvilke faktorer mener du, er med til at hæmme en risikoanalysedokumentet?
MAN-MADE DISASTER
25. Mener du, at risikoanalyserne er fyldestgørende i sig selv og kan stå alene?
a. Bør andre faktorer spille ind på risikoanalyserne i relation til MoC?
26. Hvordan kommunikerer i budskabet fra risikoanalyserne ud til folk?

27. Ifølge teorien skaber "kollektiv ignorance" risici --> Hvad mener du om udsagnet? (Uddyb begrebet!)
    b. Skaber i en arena for inkludering af personer eller er det særligt få udvalgte, som udfærdiger risikoanalyser?
    c. Hvordan sikrer I, at den med den rigtige viden eller bekymring har mulighed for at indgå i analysearbejdet?

RISK RESILIENCE

28. Hvordan, ud fra et risikoanalyseperspektiv, sikrer I jer, at jeres systemer fungerer til hver en tid?

29. Er organisationen i stand til at tilpasse sig skiftende omstændigheder? Gør i dette gennem risikoanalyserne?

30. Er risikoanalyserne i relation til MoC i stand til at fokusere på håndterings kapaciteter, hvor mindre fokus er givet på konsekvenser og mere på hvordan i vil håndtere ting, hvis de opstår i disse analyser?

31. Hvordan håndterer i mere subjektive risici frem for de tekniske risici?

32. Hvordan sikrer i at risikoanalyserne bliver udført tilfredsstillende?

Question		
33. Hvilke problemer eller udfordringer har i med at tænke på risiko og risikoanalyser i alle de ting i foretager jer for at udføre jeres arbejde?		
34. Hvilke problemer eller udfordringer har i med at vide, hvornår jeres risikoanalyser / risikoforanstaltninger er tilstrækkelige således at i kan operere sikkert?		
35. Robusthed, i litteraturen, handler om altid at have et netværk af forsvarsmekanismer til at beskytte organisationens aktiviteter, for at en ulykke ikke skal indtræffe: a. Kan risikoanalyser i relation til MoC håndtere dette, eller hvilke mulige udfordringer / problemer ser du?		