Using events to reach your goals

A study on Strategic Discourse in Institutional Change in light of a Disruptive Event

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LIST OF ABBREVIATIONS

ALPA	Air Line Pilots Association
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CRM	Cockpit Resource Management / Crew Resource Management
FAA	Federal Aviation Administration
FSF	Flight Safety Foundation
HUFAG	Human Factors in Aviation Group
ICAO	International Civil Aviation Organization
IFALPA	International Federation of Air Line Pilots' Associations
JAA	Joint Aviation Authorities
NASA	National Aeronautics and Space Administration
NLR	Netherlands Aerospace Centre
NTSB	National Transportation Safety Board

ABSTRACT

Scholars on institutional change tend to argue that particular events are inherently disruptive to an organizational field. This, however, interferes with the social constructivist roots of institutional theory. Rather, the disruptiveness of an event depends on its social construction. This can be deliberately influenced by theorization, which is a discursive and strategic method to legitimize change. So far, studies on theorization mainly focused on its outcome, instead of its process. Also, the role of events in this process has received limited attention. This study aimed to investigate the theorization process in institutional change after a disruptive event, by studying the institutionalization of CRM-training in commercial aviation after the Tenerife Air Disaster. To study this, I conducted interviews and collected documents. A discourse analysis of these data showed that theorization efforts occurred throughout the entire process of institutional change. Moreover, the process of theorization seems to have a cyclical nature. These findings add to the small body of research that understands theorization as a process that spans the entire institutional change process. Further research should focus on testing these findings, as well as investigating the actual effects of each type of theorization effort on the process of institutional change.

Keywords: institutional change, theorization, disruptive events

CONTENTS

1. Introduction

On March 27, 1977, two jumbo jets collided on the foggy runway of Los Rodeo Airport in Tenerife, Spain. This disaster, officially referred to as the Tenerife Air Disaster, is still considered to be the worst disaster in aviation history. It resulted in the loss of 583 lives (Weick, 1990). According to the accident report, the main cause for this accident was a combination of communication misunderstandings between air traffic control and both cockpits, and between the crewmembers within each cockpit (McCreary, Pollard, Stevenson, & Wilson, 1998). As a result of this disaster, international aviation rules as well as aircrafts itself underwent substantial changes. An example of these substantial changes is the worldwide adoption of Crew Resource Management (CRM), which is a training to reduce the degree of human error in the cockpit (Scales & Rubenfeld, 2014). After the Tenerife Air Disaster, it slowly became evident that human errors often were the main cause of accidents in commercial aviation (Wiener, 1995). CRM was introduced to reduce that number, by optimizing both the person-machine interface and the interpersonal communication (Wagener & Ison, 2014).

CRM differed substantially from traditional training practices. Rather than solely training pilots' technical abilities individually, it focused on training entire crews in their group performance (Helmreich & Foushee, 2010). As such, the eventual widespread adoption of CRM fundamentally changed the way in which pilots and their crew members were trained in aviation. Such changes do not happen overnight: it took more than 20 years for CRM to become widely adopted (Salas, Wilson, Burke, & Wightman, 2006). When it comes to understanding how new practices, such as CRM, become widely adopted in industries as commercial aviation, institutional theory proves to be useful.

Institutional theory tries to explain organizational behavior by assuming that this behavior is guided by an organizations' 'institutional context'. According to this theory, the widespread adoption of CRM is a change in the "dominant ways of thinking and acting" (Birkmann et al., 2008, p. 2). These dominant ways of thinking and acting are called institutions, and they are said to guide organizational behavior. In institutional theory, an institution is defined as a shared meaning system that encompasses regulative, normative, and cognitive elements that have become taken-for-granted and provide a template for individual and organizational action (Scott, 2008; Vermeulen, 2011). These systems constitute shared understandings of the world and are socially constructed through repeated interactions between organizations and other entities (Greenwood, Suddaby, &

Hinings, 2002). Institutions constitute a self-reproducing social order, because the systems and understandings that underpin the repeated interactions between organizations (e.g., social behavior) have a taken-for-granted character (Greenwood, Oliver, Sahlin, & Suddaby, 2008). This means that these deeply ingrained mechanisms that underlie institutions, guide organizational behavior without them being questioned (Vermeulen, 2011). As a consequence, institutions are very stable by nature (Munir & Phillips, 2005).

When organizations act in accordance with institutionalized rules, norms and values, they acquire legitimacy from their social environment (Vermeulen, 2011). According to Suchman (1995), legitimacy is "the generalized perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions" (p. 574). In short, legitimacy is the approval of an organization's behavior by its social environment (Greenwood et al., 2002). Certain stakeholders within social environments will only exchange resources with legitimate organizations (Greenwood et al., 2008). Legitimacy, then, is key for an organization's survival, because it makes it possible for organizations to attract important resources, such as scarce materials and political approval (Hearit, 1995; Suchman, 1995; Greenwood et al., 2008).

The social environment of organizations can be viewed from, for example, the organizational or societal level. Each level can comprise a myriad of institutions to which organizations can adapt. Scholars of institutional theory tend to analyze institutions at the level of the organizational field (DiMaggio & Powell, 1983; Scott, 1995; Hoffman, 1999), which is seen as a community of organizations that is formed around a specific theme, such as oil and gas production or commercial aviation, which forms the center of dialogue and discussion (Hoffman, 1999). While these organizations can be seen as formed around a specific theme, they often differ in the institutions to which they adapt. For example, environmentalists and oil companies may share the same organizational field (of oil production), but it is likely that they will not adapt to the same set of institutions (Hoffman, 1999). In other words, such clusters of organizations at the level of the organizational field are likely to differ from each other in their rules, norms and values that shape their institutions.

Institutions are very stable by nature, because of their reinforcing and taken-for-granted character. In order for these institutions to change, the impetus for such change sometimes has to come from outside the field (Greenwood et al., 2008). According to Greenwood et al. (2015),

institutional change occurs when particular shared meaning systems (i.e., institutions) within an organizational field become unstable, and when new organizational practices and forms become adapted or even displaced. In other words, institutional change encompasses fundamental change(s) in the rules, norms and values that are shared by particular clusters of organizations (Greenwood et al., 2002; Rao, Monin, & Durand, 2003).

One type of external trigger for institutional change that is identified in the literature is the disruptive event (Meyer, 1982; Fligstein, 1991; Lorange, Scott Morton, & Goshal, 1986). This type of event has the potential to reconfigure the composition of an entire organizational field and trigger change to the institutions that guide organizational behavior (Hoffman, 1999). According to Munir (2005), such events can take several forms, such as milestones (e.g., Earth Day or Al Gore's 'An Inconvenient Truth' documentary), catastrophes (e.g., tsunamis, nuclear accidents or oil spills), and legal/administrative happenings (e.g., public trials or parliamentary hearings). These events have the potential to act as a trigger (Hoffman, 1999) or provide a window of opportunity (Birkmann et al., 2008) for institutional change.

Despite the fact that events can have a major impact in environmental or socio-political terms, they do not necessarily trigger institutional change (Hoffman, 1999). Why is that the case? According to Hoffman (1999), the answer seems to lie in the way these events are socially constructed – how people socially make meaning of particular circumstances (Bazerman, 1990). Social constructivists emphasize that there is nothing inherently disruptive about events (Hughes, 1983; Bijker et al., 1987; Bijker & Law, 1992). Instead, our social construction can make an event disruptive, because we socially give it the disruptive meaning. In other words, if several actors at the level of the organizational field *interpret* an event as challenging their institutions, then the event can become disruptive (Hoffman & Jennings, 2011).

The process of social construction can be deliberately influenced by actors at the level of the organizational field in order to pursue a particular beneficial goal. They can do so by using theorization, which is "the rendering, or framing, of ideas into compelling formats and is critical for the ascription of legitimacy" (Clegg, Hardy, Lawrence, & Nord, 2006, p. 830). It is a strategic method that uses discourse to acquire legitimacy at the level of the organizational field. Theorization is a crucial process needed for new ideas and practices to become widely adopted. At the level of the organizational field, this theorization process often takes the form of discursive

'battles' between several actors over particular frames (Munir & Phillips, 2005). When one of these frames becomes dominant enough, this can lead to a fundamental change in institutions.

Both Greenwood et al. (2002) and Munir and Phillips (2005) stress that the role of theorization in the institutional change process should be further examined. Moreover, events have the potential to trigger institutional change, but that seems to depend on how 'disruptive' that event is framed in the theorization process (Hoffman, 1999; Greenwood et al., 2002; Morgeson et al., 2015). How those events are framed within the theorization process, and how that is used to provoke institutional change, has received only limited attention in the literature so far (Hoffman, 1999; Hoffman & Ocasio, 2001; Munir & Phillips, 2005; Nigam and Ocasio, 2010). Considering this gap in the literature, the current research aims to examine this relation by asking the following research question: *how did actors within the organizational field of commercial aviation theorize change regarding aviation safety in light of the Tenerife Air Disaster?* In order to answer this question, I formulated the following sub-questions: *how did CRM, as a new practice, develop in the field of commercial aviation?* And: *which theorization efforts regarding aviation safety, and by whom, were made to provoke change in the field of commercial aviation?* Together, these two questions will enable me to furnish a comprehensive answer to the main research question.

The findings of this research will contribute to the literature in multiple ways. First, by exploring how events are framed as disruptive in the theorization process, it will add to exploring the role of theorization in the institutional change process (Hoffman, 1999; Munir & Phillips, 2005). Exploring this role is particularly relevant because of its link to one of the central concerns of institutional theory: how legitimacy is acquired from actors in the organizational field (Greenwood et al., 2002). Second, catastrophes – as a particular type of disruptive events – have received no attention in research on theorization and institutional change so far (Hoffman, 1999; Greenwood et al., 2002; Munir & Phillips, 2005). Similar to other types of disruptive events, it is relevant to study the institutional processes (e.g., theorization) that take place after a catastrophe, because this has the potential to be the starting point of institutional change. Finally, the current research will explore theorization as a *process*, which is a perspective that received little attention in research on theorization and institutional change (Greenwood et al., 2002; Greenwood et al., 2008). Most research is focused on the outcomes of theorization (Greenwood et al., 2002), but insight into how such processes take place can be particularly relevant for the study on how actors acquire legitimacy for new ideas and practices from other actors in the field. In order to open up

the ‘black box’ of theorization as a process, a discourse analysis is applied. This analysis proves useful for studying this process, as theorization is a strategic and discursive method. As such, this research differs from the majority of institutional theory research, which is mainly focused on its *outcome*. Thus, exploring theorization as a process, and specifically the role of catastrophes within such processes, provides a unique contribution to literature on theorization and institutional change.

Furthermore, the societal or practical relevance of the current research is that it provides organizations within a particular field with an insight into how events can be framed as disruptive (i.e., making them seem significant) in order to gain legitimacy for new institutional practices (i.e., institutional change). More specific, it gives insight into which discursive strategies can be used to provoke widespread adoption of a new (institutional) practice within a particular organizational environment. In a more general way, the findings of the current research create an insight into what happens in an organizational field when catastrophes such as the Tenerife Air Disaster happen. Many entities in the organizational field may argue that ‘something needs to change’ after such events. The current research can provide an insight in how that change comes about instead of solely illustrating *what* has changed.

The remainder of this research paper consists of five sections. First, the theoretical framework is discussed in order to explain the core concepts of this study in more detail. Second, the methods section shows a detailed description of the way in which this study is executed. Third, the subsequent section consists of a detailed description of the research findings. Fourth, the discussion shows the interpretation of the significant research findings in light of the literature, and a critical reflection on the limitations of this study. Finally, this research paper finishes with the concluding remarks and recommendations for further research.

2. Theoretical background

In order to provide a comprehensive view of the existing literature that is related to the problem statement and research question, this section starts with a detailed description of institutional theory. Subsequently, two core concepts of institutional change, disruptive events and theorization, are explained in detail.

2.1 Institutional theory

In the late '80s, sociologists John Meyer and Brian Rowan (1977) laid the groundwork for new-institutionalism through their observation that organizations often used similar organizational structures – how activities are coupled to a particular goal within an organization – within a particular industry or sector. At the time, scholars of institutionalism largely focused on internal organizational dynamics in order to explain the emergence of organizational structures (Powell & Bromley, 2015). Instead of this 'old' institutionalism, Meyer and Rowan (1977) explained the emergence of organizational structures by shifting the focus to the organizations' social environment. This went against the dominant conception that managers could rationally and effectively react to the changing markets in which their organizations operated. In other words: "senior managers steered organizations by interpreting their contexts and taking appropriate actions" (Greenwood et al., 2008, p. 3). So, the senior managers' behavior was seen as rational. Furthermore, the organizational context was seen as a market (or 'technical') setting. On the contrary, Meyer and Rowan (1977) introduced the conception that organizational structures did not reflect the 'technical demands of production', but rather a highly institutionalized organizational context. This institutionalized context encompasses particular rules, which can be incorporated by organizations. If organizations do so, they will acquire legitimacy from their social environment, which is essential for an organization's survival. In other words, new-institutional theory is based on the notion that the range of an organization's possible choices and actions is defined by its institutional context (Meyer & Rowan, 1977).

In order to analyze this institutional context, scholars of institutional theory tend to focus on the level of the organizational field, which is known as the "set of organizations that, in the aggregate, constitutes an area of institutional life; key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products" (DiMaggio & Powell, 1983, p. 148-149). Or, according to Scott (1995), an organization field is "a community

of organizations that partakes in a common meaning system and whose participants interact more frequently and fatefully with one another than with actors outside the field“ (p. 56). Hoffman (1999) adds an important notion to these traditional definitions, namely that organizational fields often consist of organizations for which a particular issue or theme is central, instead of a technology or market (Hoffman, 1999). The current research brings these definitions together to adopt the following definition: as a level of analysis, the organizational field is a community of organizations – to which a particular theme or issue is central – that interact more frequently and fatefully with one another than with actors outside of the field. Inherent to this definition is that this 'community' can consist of organizations with different purposes, technologies, and institutions to which they adapt. These differences introduce the notion that "fields become a center of debate, where competing interests negotiate over issue interpretation" (Hoffman, 1999, p. 3). These debates can resemble institutional war (White, 1992) in which different clusters of organizations are in conflict, out of which "they gain skills and capital for future conflict" (Greenwood et al., 2008).

Organizational fields can comprise a myriad of institutions. Scott (2008) defines institutions as "multi-dimensional social structures that consist of regulative, normative and cultural-cognitive elements that provide stability and meaning and provide direction for the behavior of certain actors (individuals and organizations)" (p. 48). More recently, Vermeulen (2011) defined institutions as shared meaning systems that encompass rules, norms and values that have become taken-for-granted. The current research synthesizes these definitions into the following definition of institutions: institutions are shared meaning systems that encompass regulative, normative, and cognitive elements that have become taken-for-granted and provide a template for individual and organizational action. According to this definition, institutions have two important characteristics. The first is that institutions are understood as shared meaning systems, which means that they form the basis of how actors socially make sense of reality. This is underpinned by the theory of social constructivism, which takes the stance that people socially make meaning of their environment. This means that meaning is constructed through interaction with others and eventually forms taken-for-granted assumptions about reality (Greenwood et al., 2008). This meaning is partly constructed through discourse (Phillips, Hardy, & Lawrence, 2004), which are texts that can take forms ranging from conversations to books and articles – as long as language is involved (Greenwood et al., 2008). Taken together, institutions are socially constructed shared meaning systems that are partly constructed through discourse.

The second important characteristic of institutions is that, because they are shared meaning systems, they provide a template for action. In other words, institutions shape the boundaries for organizational legitimate behavior (Thornton, Ocasio, & Lounsbury, 2012). Legitimate behavior within an organizational field is essential for an organization's survival (Scott, Ruef, Mendel, & Caronna, 2000), because it emphasizes the degree of cultural support for an organization (Meyer & Scott, 1983). Sufficient cultural support provides stability to organizations (Greenwood et al., 2002), and provides access to resources that are necessary for survival, such as scarce materials, investments or political support (Hearit, 1995). As Greenwood et al. (2008) stated it, legitimacy ensures that organizations "avoid social censure, minimize demands for external accountability, improve their chances of securing necessary resources and raise their probability of survival" (p. 4). One formal definition comes from Suchman (1995), who defines legitimacy as the "generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and systems" (p. 574). This definition shows that legitimacy and institutions are interrelated, because it states that given a particular institution, legitimacy can be acquired from actors in the field by showing particular organizational behavior that conforms to that institution. In other words, legitimacy can be seen as a reflection of the extent to which an organization is aligned to a certain institution (Scott et al., 2000). Explaining institutions in more detail can help with understanding what legitimate organizational behavior entails.

According to Scott (1995), institutions comprise three (analytically) different elements: regulative, normative or cognitive. The regulative element of an institution is characterized by rule setting, monitoring and sanctioning by powerful and authoritative actors. The mechanism within this element that steers organizational behavior often takes the form of regulations and, therefore, has a coercive nature. Actors with such power are, for example, regulators. With this institutional element, legitimate organizational behavior is meeting these regulations. For example, when an organization adopts new pollution control technologies because of new environmental regulation, it acquires legitimacy from actors in the organizational field (DiMaggio & Powell, 1983). The influence of the regulative element on individual organizations is very strong, because organizations will often get punished through enforcement and sanctions if they do not show appropriate, legitimate behavior (Scott, 2008).

The normative (or social) element of an institution is characterized by values and norms. Values comprise the conceptions of desirable behavior together with standards to which behavior can be assessed, and norms specify what should be done in order to reach these values (Scott, 2008). In other words, norms "define legitimate means to pursue valued ends" (Scott, 2008, p. 64). Together, values and norms define the *goal of the game* and the way *the game is to be played.* They form normative expectations with respect to how specific actors are supposed to behave (i.e., prescriptive) (Scott, 2008). An example of how these normative expectations function, is through the role of professions. Within particular professions (e.g., doctors, teachers, lawyers), similar education and training instills similar values and norms. As a result, particular professions can entail similar normative expectations of what is legitimate or 'proper' professional behavior (Greenwood et al., 2008). When organizations align their behavior with these values and norms, they acquire legitimacy from the field (Vermeulen, 2011). Instead of the sanctions that result from non-legitimate behavior within the regulative element, non-legitimate behavior within the normative element results in strong feelings of shame and disgrace. Such emotions can act as a strong impetus for showing legitimate organizational behavior in accordance with the normative element of an institution (Scott, 2008).

The third element of an institution is the cognitive (or cultural) element. According to Scott (2004), the cognitive element is the "deeper foundation of institutional forms; the infrastructure on which not only beliefs, but norms and rules rest" (p. 5). This element comprises symbols (e.g., words, signs and gestures), cultural rules, and cognitive frames that "(…) guide our understanding of the nature of reality and the frames through which that meaning is developed" (Hoffman, 1999, p. 6). These symbols, cultural rules, and cognitive frames are often taken-for-granted, meaning that organizations show behavior in accordance with them without conscious thought. In other words, conforming behavior is shown as it is 'just how we do things over here' (Scott, 2008). Taken together, these regulative, normative, and cognitive elements form a set of filters through which certain themes or issues are perceived and actions are chosen (Hoffman, 1999).

As organizations act in accordance with a constellation of institutions in order to acquire legitimacy by the field, they often start to look alike. Scholars of institutional theory term this process of homogenization as isomorphism (literally, 'same shape') (Greenwood et al., 2008). DiMaggio and Powell (1983) define isomorphism as "(…) the constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions" (p.

149). In other words, isomorphism is the process of homogenization of organizations because of organizing and acting in accordance with the same constellation of institutions in order to acquire legitimacy.

2.2 Institutional change

Because of the reinforcing mechanism of organizations acting in accordance to particular constellations of institutions, institutions can become very stable. Moreover, because of the taken-for-granted character of particular institutions, behavior in accordance to them can become an unconscious and automatic response. Taken together, institutions can be very resistant to change. As stated earlier, institutional change is understood as the process whereby particular shared meanings within an organizational field become unstable and when the resulting organizational agreements associated with them become adapted or even displaced (Greenwood et al., 2015). In other words, institutional change occurs when particular institutions within an organizational field become unstable and when new ideas and practices become adopted. When institutional change is seen as a process, it can be divided into stages of change. For example, Tolbert and Zucker (1996) divided the institutional change process into three different stages: pre-institutionalization, semi-institutionalization and full institutionalization. The pre-institutionalization phase can be characterized by having limited knowledge and few adopters of the new practice. Next, in the semi-institutionalization phase, there is a fair diffusion of the practice in the field with the practice having some kind of normative acceptance. Finally, when full institutionalization has taken place, the practice has become taken-for-granted as a practice that is effective and necessary (Tolbert & Zucker, 1996; Kostova & Roth, 2002). These three stages served as the bases of a more recent model of institutional change by Greenwood et al. (2002). This model concretized two important parts of institutional change, disruptive events (or *jolts*) and theorization, which will now be discussed in detail.

2.2.1 Disruptive events. Since institutional change can be difficult because of the reinforcing and taken-for-granted character of institutions, sometimes the impetus for such change has to come from outside the organizational field (Munir, 2005). Such an impetus can be caused by particular external events that can be disruptive to the field. In order to understand the notion of disruptive events, it is important to define the concept of ‘event’ first. Morgeson et al. (2015) define an event as external observable actions or circumstances that are bounded in time and space and

involve the intersection of different entities. The 'disruptive' event is a central concept in the literature in explaining institutional change, and is also referred to as jolts, shocks, or discontinuities (Meyer, 1982; Fligstein, 1991; Lorange et al., 1986). These concepts all have different interpretations for the term 'disruption'. First, Meyer (1982) defined an environmental jolt as "transient perturbations whose occurrences are difficult to foresee and whose impacts are disruptive and potentially inimical" (p. 515). Second, Fligstein (1991) defined a shock as a "perceived crisis, which creates a reconstruction of the rules or models of new organizational strategies that undermine the existing rules" (p. 315). Third, Lorange et al., (1986) defined a discontinuity as "irregular, non-linear and erratic change due to social, economic, technological and political forces" (p. 18). Besides these general definitions, disruptive events are said to precipitate change (Munir & Phillips, 2005), cause a reconfiguration of the constellation of an organizational field (Hoffman, 1999), and induce the need for "more deliberate, effortful information processing and changes to existing behaviors and features or the creation of new behaviors, features and events" (Morgeson et al., 2015, p. 521).

Such disruptive effects can be triggered by four different types of events: milestones, catastrophes, legal/administrative happenings, and investigative reports (Munir, 2005; Hannigan, 2006). First, milestones are events such as Earth Day or the Rio (Earth) Summit (Hannigan, 2006). Second, catastrophes are events like oil spills, nuclear accidents and toxic fires. This type of disruptive events often involves (the possibility of) large loss of life (Hannigan, 2006). Third, legal/administrative happenings are events such as parliamentary hearings, landmark trials, and the release of particular white papers (Munir, 2005; Hannigan, 2006). Finally, investigative reports are events such as the release of Rachel Carson's *Silent Spring* in the U.S., which called attention to the use of toxic chemicals and its threat to the public (Lear, 1993; Hoffman & Ocasio, 2001; Munir, 2005). While these events can be disruptive in the sense that they trigger institutional change, stating that particular events are inherently disruptive goes against the social constructivist roots of institutional theory (Munir, 2005). Instead, no single event is inherently disruptive (Hughes, 1983; Bijker et al., 1987; Bijker & Law, 1992). Because events are socially constructed, the adjective 'disruptive' is socially determined. For example, Munir and Phillips (2005) showed how Kodak's introduction of the roll-film camera (event) initially did not create any institutional change. Only when Kodak managed to give this innovation a completely other meaning, it induced the institutional change that was hoped-for. As such, Kodak managed to transform an event into a

disruptive event. This example reflects a process of institutional change in which a particular actor (such as Kodak) tries to manage the meaning of a particular event (as being disruptive) in a deliberate and strategic manner. Scholars of institutional theory call this process 'theorization' (Munir, 2005).

2.2.2 Theorization. Besides reacting to environmental demands by adapting to particular institutions, some actors can also proactively try to gain control over their environment. In doing so, actors make use of strategic actions in order to acquire legitimacy for change (Greenwood et al., 2008). This strategic action occurs when, often because of a particular event, the taken-for-granted beliefs of institutions become unsettled. When such beliefs become unsettled, meaning has to be made of the new situation. This sensemaking of new circumstances can be seen as a part of the social construction process (Maitlis & Christianson, 2014). Actors within a particular field can deliberately influence this process of social construction by using theorization, which is a strategic method to legitimate change that fits actors' specific interests. In literature on institutional theory, theorization is defined as a strategic method for deliberately influencing the process of social construction by framing ideas and practices into compelling formats in order to legitimate change (Greenwood et al., 2008). The 'theorizing agents' that practice such efforts, are, for example, corporations (Munir & Philips, 2005), professional associations (Greenwood et al., 2002), and the media (Rao et al., 2003). These agents create compelling formats through discourse, which are "structured collections of meaningful texts" (Phillips, Lawrence, & Hardy, 2004). The term 'texts' not only refers to written texts, but to "any kind of symbolic expression requiring a physical medium and permitting of permanent storage" (Taylor & Van Every, 1993, p. 109). Taken together, theorization is the discursive and strategic method of framing new ideas and practices to gain legitimacy for new institutional practices (Greenwood et al., 2015).

In studies on theorization, Munir (2005) was one of the first to study this concept as a process, instead of solely focusing on its outcome. By studying the institutional change from photography to digital imaging in the photographic field, he showed that theorization spans the entire institutional change process. These findings go against the general conception of scholars on institutional theory that sees theorization as a phenomenon that only occurs at one particular moment in the institutional change process (Greenwood et al., 2002). The current research adopts the conception of theorization by Munir (2005), because theorization is needed for an event to

become disruptive, and so it occurs much sooner in the institutional change process than Greenwood et al. (2002) argue.

According to Tolbert and Zucker (1996), theorization can be split into two distinct tasks: specification and justification. In the beginning of the theorization process, actors try to specify the general organizational failing, which challenges the adequacy of existing ideas and practices. Put simply, the first task is to discredit the status quo (Greenwood et al., 2008). After this becomes unsettled, the next step is to justify new organizational arrangements (i.e., ideas and practices) as the right solution. Taken together, actors within an organizational field can take these strategic steps for acquiring legitimacy for the new organizational arrangements in order to become widely adopted – thus institutionalized. With disruptive events, for example, actors can try to specify the general organizational failing in the field by mentioning a particular disruptive event (specification) and then provide new ideas and practices in order to solve these kinds of failure (justification). In order to provide a schematic overview of the relationships between the previously discussed concepts, see Figure 1. The crucial factor in the process of theorization is discourse, which acts as the means by which the 'compelling formats' can be formed (Greenwood et al., 2015). In other words, discourse forms the means by which actors at the level of the organizational field can be persuaded to adopt new organizational arrangements (Phillips, Lawrence, & Hardy, 2004). The aim of the current research is to investigate the process of theorization by investigating the strategic discursive acts that actors used in light of the Tenerife Air Disaster to invoke (wider) adoption of CRM. In order to show how this was examined, the methods section will provide a detailed description of the research process.

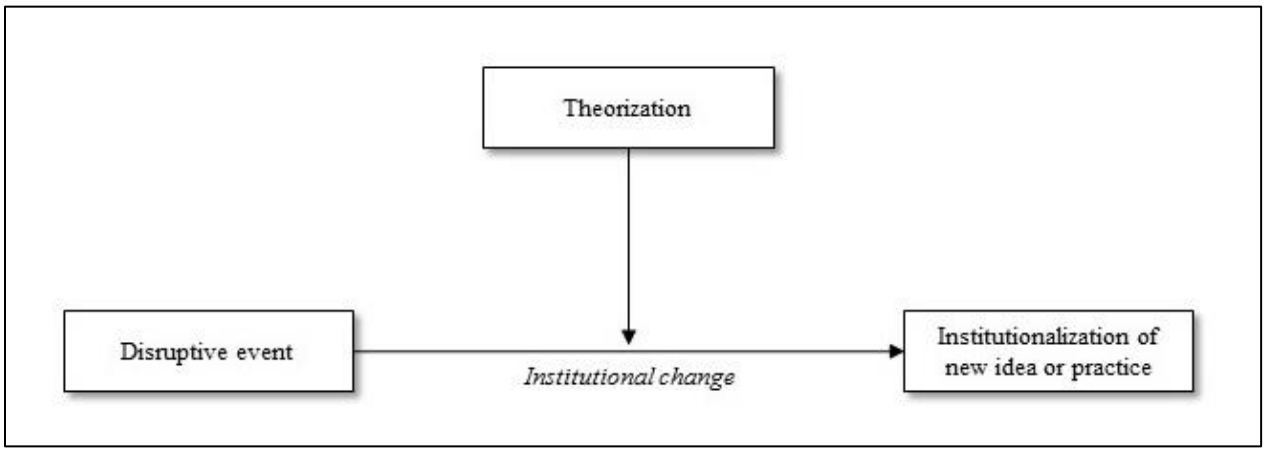

Figure 1. Conceptual framework of the core concepts.

3. Methods

This section will provide a detailed description of how the current research was conducted. It consists of five parts. First, the context of the case of study is described. Second, the research design is discussed in order to describe the type of design used in the current research. Third, the data collection is discussed in order to describe which sources of data were used, why they were used and how this data was collected. Fourth, the data analysis is discussed in order to explain how the research data was analyzed. Fifth, the research assessment criteria are discussed in order to show how the quality of this research was assured. Finally, the research ethics are discussed in order to show that the ethical considerations that might have occurred during the research process have been taken into account.

3.1 Context

On March 27, 1977, KLM flight 4805 and Pan American World Airways (Pan Am) flight 1736 were bound for Las Palmas airport at Tenerife. However, because of a bomb explosion at this airport, both Boeing 747's had to land on Los Rodeos airport – the second airport of Tenerife. The KLM airplane was the first to land at 1:38 PM, followed by the Pan Am airplane at 2:15 PM. Because of the airport's limited taxi space, the Pan Am airplane had to wait for departure of the KLM airplane. At 2:30 PM, the Las Palmas airport reopened. At that time, the Pan Am airplane was ready to depart, but the KLM airplane was delayed because of refueling of the airplane and the fact that its passengers had left the airplane (Weick, 1990). When all was settled, the KLM airplane was requested to taxi down the takeoff runway and to turn around at the end. It had to stop there and wait for further instructions. The Pan Am airplane was requested to follow the KLM airplane and leave the takeoff runway at taxiway C3. At that taxiway, the Pan Am airplane had to taxi down the runway that was parallel to the takeoff runway and eventually pull in behind the KLM airplane (Weick, 1990). At the time, both airplanes and air traffic control had very poor sight, because of the foggy weather. As a result, all parties were completely dependent on their radios in acquiring information about the runway positions (McCreary et al., 1998).

When the KLM airplane got to its position on the takeoff runway, it did not hold as was instructed (McCreary et al., 1998). Instead, it started moving, and the captain reported: "We are now at takeoff". Both the Pan Am airplane and air traffic control were not certain what was meant by this message. In a later statement, the head controller of air traffic control said that he understood

the "we are now at takeoff" message of the KLM captain as being ready for takeoff, but not as an actual takeoff (McCreary et al., 1998). Shortly after the message of the KLM captain, the Pan Am crew restated air traffic control that they would report to air traffic control when the Pan Am airplane was clear of the takeoff runway. This communication was heard by the KLM crew. When the air traffic control asked the KLM crew: "Is he not clear then, that Pan Am?", the captain of the KLM airplane replied: "Yes". After that reply, there was no further conversation (Weick, 1990). Just 13 seconds later, at 5:06 PM, the airplanes collided on the takeoff runway. Not a single person of the KLM flight survived, and only 61 persons of the Pan Am survived (Weick, 1990). The collision eventually led to a total loss of 583 lives, and is still considered as the worst accident in aviation history (Smith, 2013). Today, this accident is often referred to as the Tenerife Air Disaster (Weick, 1990).

The Tenerife Air Disaster is a clear example of critical human errors in communications and decision-making. Cockpit crews were trained well, but apparently under conditions of crisis they did not react accordingly (McCreary et al., 1998). To prevent disasters like the one in Tenerife, fundamental changes have been made in aviation. One of these fundamental changes is the introduction of Crew Resource Management (CRM), which is a training that initially was defined as "the effective utilization of all available resources – hardware, software and the livewire – to achieve safe, efficient flight operations" (Lauber, 1984, p. 9). Later on, it has been defined as a set of "instructional strategies designed to improve teamwork in the cockpit by applying well-tested training tools (e.g., performance measures, exercises, feedback mechanisms) and appropriate training methods (e.g., simulators, lectures, videos) targeted at specific content (i.e., teamwork, knowledge, skills and attitudes)" (Salas, Rozell, Mullen, & Driskell, 1999, p. 163). According to Helmreich and Foushee (2010), CRM includes "optimizing not only the person-machine interface and the acquisition of timely, appropriate information, but also interpersonal activities including leadership, effective team formation and maintenance, problem-solving, decision-making, and maintaining situation awareness" (p. 5). In short, CRM involves learning these aviation-related human factors concepts and learning how to apply them in practice, in order to reduce human error.

In 2001, CRM became mandatory for commercial flight crews (O'Connor, 2002). Today, it is required in 185 countries (Zill & Dewar, 2009). CRM was, however, not immediately adopted by all airlines. Instead, it took more than 20 years to become widely adopted in commercial aviation (Wiener, 1995). The meaning of CRM has substantially changed over these years (Helmreich,

Merritt, & Wilhelm, 1999). For example, CRM began as Cockpit Resource Management before it was renamed as Crew Resource Management. Similarly, CRM evolved from an individual-level training to a crew-level training (Salas, Burke, Bowers, & Wilson, 2001). Because the current research assumed that particular actors in the field of commercial aviation theorized the adoption of this new practice in light of the Tenerife Air Disaster, it also focused the data analysis on these different meanings that were given to CRM.

3.2 Research design

In order to gain insight into the process of how actors in the field of commercial aviation theorized change in light of the Tenerife Air Disaster, the current research performed a qualitative case study. Because of the focus on theorization as a *process,* qualitative research is particularly suitable for exploring this process. Qualitative research refers to the approaches and methods for studying social phenomena (Marshall & Rossman, 1999). As the term already suggests, this type of research primarily uses qualitative data (i.e., textual and visual material), which is particularly useful for understanding processes (instead of outcomes) and for providing contextual information about the phenomenon under study (Lee, 1999; Saldana, Leavy, & Beretvas, 2011).

The type of qualitative research that is adopted in the current research has three key characteristics. First, it is based on inductive methodology, which means that it generates theory from research instead of vice versa. Second, it takes an interpretivist position, which means it is focused on "understanding the social world through an examination of the interpretation of that world by its participants" (Bryman, 2012, p. 380). In other words, the interpretivist researcher tries to get access to the phenomenon under study by examining the *interpretations* of that phenomenon by its participants. Third, it takes a constructionist position, which means that social properties are seen as outcomes of social interactions, rather than as being independent of social actors (Bryman, 2012). In other words, social constructivists say that "truth and meaning do not exist in some external world, but are created by the subject's interactions with the world" (Gray, 2013, p. 20). Together, these characteristics say the following: the social world is socially constructed and this can be examined by analyzing the interpretation of that world by participants, which eventually leads to new theory.

The current research conducted a case study in order to collect in-depth knowledge about the phenomenon under study. In general, a case study is defined as: "an empirical inquiry about a contemporary phenomenon (e.g., a 'case'), set within its real-world context – especially when the

boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p. 18). Case study research is particularly useful for addressing broad research questions about the 'how' and 'why' of a particular phenomenon, because it can provide rich, in-depth information about the unit of analysis (Rowley, 2002; Swanborn, 2010). Furthermore, case studies can be used to cover contextual conditions and discover how particular processes develop over time (Swanborn, 2010). Especially in the current research, the Tenerife Air Disaster nor CRM can be separated from its context (Baxter & Jack, 2008). Moreover, in-depth information was needed to discover the dynamics between these concepts, and so case study research is particularly useful.

The case of the current research is the adoption of CRM (i.e., institutional change) in commercial aviation in the timespan of the Tenerife Air Disaster on March 27, 1977 until 2001 - the year of widespread (mandatory) adoption of CRM (O'Connor, 2002). This case provides a clear example of the process wherein a new institutional practice is adopted. In the current research it is assumed that – during this process – several actors within the field debated/conflicted over the meaning of CRM and why it should be adopted in light of the Tenerife Air Disaster. It is probable that the meaning of CRM changed after the selected period, but because the focus is on theorizing efforts to induce the widespread adoption of CRM, the period from 1977 until 2001 is sufficient. After all, regulations in 2001 ensured this (mandatory) widespread adoption.

In order to analyze the institutional dynamics in this case, I selected the organizational field of commercial aviation as the unit of analysis. As previously mentioned, the organizational field is defined as a community of organizations – to which a particular theme or issue is central – that interact more frequently and fatefully with one another than with actors outside of the field. As this is an analytical concept, the field of commercial aviation has been defined after the data analysis. Accordingly, this community of organizations is (operationally) defined as all commercial airlines, federal agencies (e.g., accident investigation and aviation research), agencies of international organizations, newspapers, trade journals, pilot unions, and regulators, located in the U.S. and Western Europe. Analysis of the data showed that these organizations interacted more frequently and fatefully with one another than with actors outside the field of commercial aviation.

3.3 Data collection

The current research used two different types of data in order to guarantee research credibility: documents and interviews. The first type of data is secondary, meaning that it already exists independent of the current research (Sørensen, Sabroe, & Olsen, 1996). Secondary data is especially useful in case study research with a historical focus, because data from long periods of time is stored and accessible. Because the institutionalization of CRM took more than 20 years, this data proves useful. Furthermore, while it has been used for other purposes, the reanalysis of secondary data might offer new interpretations and insights (Bryman, 2012).

Initial data collection of the secondary data led to 98 documents. This number was reduced by selecting documents on the basis of their sources, instead of on the usefulness of the documents. Eventually, this led to a total of 50 documents with a total of 1,395 pages. These documents consist of 26 trade journal items, 12 newspaper items, 7 reports, and 5 other organizational documents. Items from trade journals have been mostly collected through their online databases. Only one of these journals, Flying Magazine, has been collected through Google Books. Newspaper items have been collected through the LexisNexis (online) database, which is linked to many newspaper databases. The reports and other documents have been collected through intensive search on Google. In short, all data collection was done on the internet (electronically). The collection or search method on all of these sources was similar. During this data process, several search terms were (creatively) used, such as *Tenerife Air Disaster*, *crew resource management, cockpit resource management, CRM, human factors,* and *aviation accidents*. Most of the time, a combination of these terms was used in order to find theorizing efforts in light of the Tenerife Air Disaster. Besides this direct search for items, many texts referred to others. Because the current research is interested in the interconnectedness of texts, those texts would be collected too. In such a way, coherent 'bodies of texts' (i.e., discourses) were found. In other words, during the process of data collection, there was a main focus on references to other documents, terms, or actors that could provide future directions for the data collection process so that coherent bodies of texts and documents could be found. In order to clarify why the particular types of documents were chosen and what these documents contained, they will now be discussed in detail.

The first type of documents, trade journals, was of particular importance for the current research, as "they act as a historical record of key issues and events as perceived from within an industry as well as of the motivating factors behind industry actions" (Hoffman, 1999, p. 356).

Moreover, they reflect the situated perspectives of specific audiences within particular industries (Hoffman, 1999). As the current research focused on theorization as a strategic, deliberate action for legitimizing change, trade journals prove useful in uncovering the motives behind these efforts. Data collection led to items from four different trade journals: Aviation Week, Flying Magazine, Human Factors Digest, and Flight Safety Digest. In selecting journals as well as newspapers, there was one strict requirement: they had to be active before the Tenerife Air Disaster took place, and these journals/newspapers should be accessible through the internet. The next selection was based on the characteristics of the remaining trade journals. Aviation Week as well as Flying Magazine are premier, independent aviation trade journals that include news and information about the aviation industry (Locatory, 2015). Both journals cover many subjects, including safety – which is closely related to the case of the current research. Moreover, these journals can uncover actors that try to theorize change by producing particular texts.

The other two trade journals, Human Factors Digest and Flight Safety Digest, are premier trade journals that are particularly concerned with aviation safety. These journals are published by, respectively, the International Civil Aviation Organization (ICAO) and the Flight Safety Foundation (FSF). The ICAO is a specialized agency of the United Nations that aims to develop standards and recommendations for flight safety in civil aviation ("About ICAO", n.d.). Through their trade journal, they try to reach out to the aviation industry in improving safety in civil aviation (International Civil Aviation Organization, 1989). The FSF is an independent and international non-profit organization that aims to improve aviation safety by providing the industry with expert safety guidance ("About the foundation", n.d.). The trade journals of these two organizations are useful in exploring the process of theorizing change (i.e., the adoption of CRM). As both organizations are particularly concerned with aviation safety, it is presumable that they theorized change through particular texts in light of the Tenerife Air Disaster.

The second type of documents, newspaper items, are useful for providing rich information about particular topics (Bryman, 2012), and often "include quotations and reactions from individuals speaking on behalf of key actors at the field level" (Reay & Hinings, 2005, p. 361). This is particularly useful for investigating the process of theorization, because such quotations and reactions could reflect the meaning that actors try to create in their theorization efforts. The newspaper items originated from two international newspapers: the New York Times and the Washington Post. The reason for solely selecting these newspapers is their long-established,

international scope and their extensive online historical documentation. The third type of documents, reports, consisted of reports such as conference and training reports. These reports can be particularly useful for gaining insights in specific happenings in the field. Finally, the 'other' documents consisted of documents directly published by particular actors in the field, such as NASA, and were seen as direct efforts of theorization.

The second type of data, primary data, was collected through conducting interviews. Unlike secondary data, primary data is "original data collected for a specific research goal" (Hox & Boeije, 2005, p. 593). One major advantage of collecting primary data is that the entire data collection process can be tailored to the specific research question, which ensures a coherent study and data that is primarily targeted at the research question. In order to apply triangulation in favor of the credibility of the current research, 8 interviews were conducted with an average duration of 70 minutes. Interviews are not only an efficient way of collecting primary data, but can also provide in-depth information from particular experts (Swanborn, 2010). Moreover, interviews can be helpful in crosschecking particular findings from the analysis of secondary data in order to ensure credibility (Bryman, 2012). In the current research, interviews were particularly relevant to further exploring the theorization process in light of the Tenerife Air Disaster as well as particular findings from the discourse analysis of the documents.

The group of interviewees consisted of experts on CRM, which were either CRM-trainers, general aviation experts, or pilots, or a combination of these. For a detailed, anonymous description, see Table 1. After permission, all interviews were recorded and transcribed. These transcripts can be found in Appendixes 4.1 – 4.8, in the same order as displayed in Table 1. In the description of the interviewees' experience in this table, as well as in the interview transcripts, some features have been left out in order to make it impossible to trace these persons. Most of these experts have been found through criterion sampling (Bryman, 2012). In searching through profiles on LinkedIn, the focus was on people that met the criterion of high, long-lasting (i.e., more than 10 years) engagement in CRM-training, preferably from the early days of CRM. These candidates were approached through LinkedIn's direct message. The content of this message can be seen in Appendix 1. Besides this, snowball sampling was applied, which led to interviewee number 5. Snowball sampling means that interviewees were asked if they could recommend anyone who is an expert on CRM in aviation (Bryman, 2012). As such, two different types of purposive sampling have been used in searching for potential interviewees (Bryman, 2012).

Table 1. An overview of interviews and the interviewees' profession and experience.

No.	Duration	Nature	Profession	Experience
1.	112 minutes	In-Person	Pilot	Senior captain and senior CRM-trainer at KLM.
2.	57 minutes	In-Person	Pilot	Senior captain and senior CRM-trainer at KLM, prominent member of the VNV.
3.	45 minutes	Telephone	Pilot	Senior captain and senior CRM-trainer at KLM. Has been a prominent member of the VNV in the past.
4.	60 minutes	Telephone	Pilot	Senior captain at Transavia, prominent member of the IFALPA.
5.	73 minutes	In-Person	CRM-trainer	Experienced and independent CRM-trainer in aviation and other industries, Has been a human factors expert at KLM and was involved in the development and training of CRM at KLM from the first day.
6.	98 minutes	In-Person	CRM-trainer	Experienced and independent CRM-trainer in aviation and other industries.
7.	72 minutes	In-Person	Researcher	Training specialist at the NLR, prominent member of the HUFAG.
8.	50 minutes	Telephone	Aviation expert	General and independent aviation expert, former senior captain at KLM.

The interviews were semi-structured, meaning that I used a general interview guide (Turner. 2010; Bryman, 2012). The reason for choosing a semi-structured interview is that it provides flexibility as well as a relatively coherent approach to all interviewees. It is flexible in the sense that the researcher can also ask questions that are not included in the interview guide, and it is a relatively similar approach to all interviewees in the sense that all questions on the interview guide will be asked and "similar wordings will be used from interviewee to interviewee" (Bryman, 2012, p. 471). During the creation of the interview guide, the focus was on formulating clear, open-ended, and neutral questions (Bryman, 2012). Also, because of the historical focus in the current research, the questions were ordered in such a way that they facilitated the memory retrieval of interviewees.

The following sensitizing concepts were used to formulate questions for the interview guide: CRM-evolution, promotion and resistance. First, the evolution of CRM is seen as the general development of the training, changes in its meaning and the scope of its adoption in the time period that was selected for this study. As such, this has led to questions like: 'what do you think has been the reason for introducing CRM-training?' or 'what did CRM look like at the time of its

introduction?' Second, promotion is seen as acts of theorizing the adoption of CRM, which has led to questions like: 'did particular parties strongly advocated for training CRM?'. Finally, resistance is seen as all actions against the adoption of CRM. This has led to questions like: 'was there any resistance against this new type of training?' Although resistance may seem less related to the research question than the other two sensitizing concepts, insight in this concept was of particular importance. Insight in resistance could not only have provided directions for further theorizing efforts for CRM-adoption, it could also display the frames used by the actors that resisted CRM. Together, exploring these three concepts during the interviews was presumed to be sufficient to answer the research question. For the complete interview guideline, see Appendix 2.

3.4 Data analysis

The current research conducted a discourse analysis in order to explore how actors theorized change in light of the Tenerife Air Disaster. It is important to note that the processes of data collection and data analysis were not strictly sequential. Rather, these processes went hand in hand, as exploring the data sometimes led to directions for new data collection (Swanborn, 2010). In general, the term 'discourse' refers to "an interrelated set of texts and the associated practices and production, dissemination, and reception that bring an object into being" (Greenwood et al., 2008, p. 712). Such texts (e.g., written texts, conversations, symbols) do not hold meaning individually. Rather, it is the interconnection of texts, the nature of their production, dissemination and consumption that creates or holds meaning. Discourse analysis is the analysis that explores this process by providing insight into how texts are made meaningful and how they affect social construction by making meaning (Greenwood et al., 2008). The type of discourse analysis that was performed in the current research is critical discourse analysis (CDA). This sub-type of discourse analysis is especially focused on the politics and context of discourse. It sees language as a power resource that can be used for socio-cultural change (Wodak & Meyer, 2001; Bryman, 2012). As theorization is understood as a discursive means for change too, CDA proves useful for examining this process.

CDA is closely related to the social construction of institutions. As mentioned earlier, social construction is the mechanism that underpins institutions (Greenwood et al., 2008). Moreover, Phillips et al. (2004) argue that social construction is constituted through discourse, and so are institutions. The current research adopts the notion of Phillips et al. (2004) that institutions are constituted through discourse. Hence, CDA proves to be a useful framework to analyze the

constructive role of discourse in organizational and inter-organizational processes (Phillips & Hardy, 2002) and provides techniques to analyze how socially constructed ideas and objects are created (Munir & Phillips, 2005). This type of analysis can be particularly useful in analyzing how actors in the field of commercial aviation theorized change (i.e., the adoption of CRM) in light of the Tenerife Air Disaster. After all, theorization is the process whereby social construction is strategically influenced – by using discourse – to pursue a particular goal. From the perspective of discourse and institutional theory, the process through which new institutional practices come into being (i.e., institutional change) becomes empirically accessible (Greenwood et al., 2008).

According to Starks and Trinidad (2007) discourse analysis is "examining how understanding is produced through a close look at the words. Interested in *how* the story is told, what identities, activities, relationships, and shared meaning are created through language." (p. 1373). Discourse analysis focuses on so-called language-in-use, which is the way in which individuals pursue particular goals through language (Starks & Trinidad, 2007). The current research incorporated this focus on strategic use of language into the general coding process of most qualitative research (Bryman, 2012), which refers to "the steps the researcher takes to identify, arrange, and systematize the ideas, concepts, and categories uncovered in the data" (Given, 2008, p. 85). As such, during the coding process of the current research, the focus was on the general evolution of CRM (e.g., its introduction, meaning, and adoption) and *how* understanding or meaning is produced through texts of particular actors. As particular actors try to accomplish their goals through the production of texts, the focus was also on the motivation behind these texts in order to explore these goals.

All documents and transcripts were analyzed through ATLAS.ti, which is software that is specialized in coding qualitative data. The reason for choosing ATLAS.ti, is because this software consists of all basic methodological functionalities, is user-friendly (Flick, von Kardoff, & Steinke, 2004), and is complementary for students of the Radboud University. One disadvantage of this software was the impossibility to make a code tree. This was resolved by making the code tree in Microsoft PowerPoint. The actual analysis in ATLAS.ti consisted of three steps. In the first step of the coding process, open coding, each relevant part of a document's text was given one or more descriptive code(s). In the open coding step, the researcher stays close to the text by solely reflecting the meaning of a text by giving it a code (Swanborn, 2010). According to Starks and Trinidad (2007), open coding is a process of decontextualization in which the data is removed from

its context. The following two steps of the coding process, axial coding and selective coding, are processes of recontextualization in which codes are examined for patterns and subsequently are integrated and organized around central themes. In the second step, axial coding, these terms or concepts are groups into categories (Bryman, 2012). Or, as Swanborn (2010) stated it, in axial coding "the initial codes are collected, mutually related, and ordered into an analytical framework" (p. 119). Finally, during the selective coding, relevant categories were linked together and linked to the theoretical concepts of the literature. Both the documents and interview transcripts were analyzed in this manner.

Key to this process was the generation of memos. During the coding process, lots of thoughts came to mind about potential interpretations of open or axial codes. Through keeping a record of memos, I made notes of these thoughts to either serve as a reminders about the (underlying) meaning of particular codes or as a reminder about possible linkages between several codes (Given, 2008; Bryman, 2012). In other words, memos are particularly helpful for researchers to "crystallize ideas and not to lose track of their thinking on various topics" (Bryman, 2012, p. 573). Moreover, during this process, I tried to remain open to multiple possibilities instead of solely focusing on just one explanation for the data (Strauss & Corbin, 1998). Memos could add to this too, because different ideas could be recalled and tested.

Eventually, the data analysis has led to 35 codes, consisting of codes from all steps in the coding process. In order to provide an overview of these codes, they were processed into a code tree, which can be seen in Figure 2. Take a look at, for example, the selective code of theorizing change in the code tree. The rows of codes that are stated underneath the axial codes 'specifying the need' and 'providing the solution' are open codes. These codes describe the meaning of several texts. Take, for example, the 'shifting focus' code. This code illustrates texts in which particular actors promote the shift in focus from training pilots in their technical skills to training pilots in their 'softer', non-technical skills. This code would be given to the following quotes/texts: *"We've spent 30 to 40 years teaching people how to use systems, but we've never gotten into the part that's just as important, the people who fly the planes".* Taken together, the two axial codes make up the selective code 'theorizing change', which is linked to the theoretical concept of theorization. The codebook in Appendix 3 displays these code names, descriptions and sample quotes.

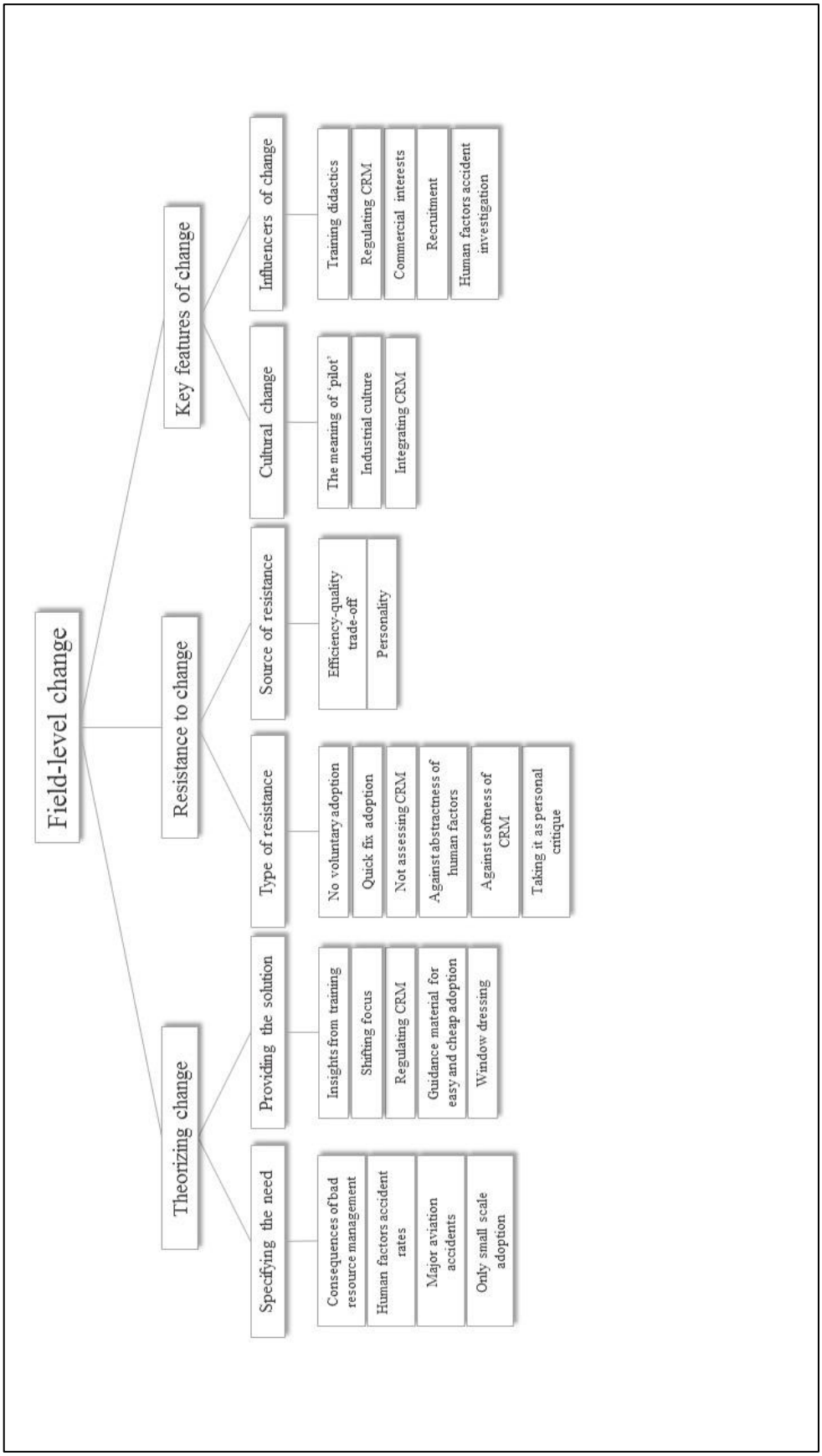

Figure 2. The code tree of the data analysis.

3.5 Research assessment criteria

In order to assess the quality of a research, many scholars focus on reliability and validity – two criteria that are common in quantitative research (Golafshani, 2003). However, there is a discussion among qualitative researchers about the applicability of these criteria on qualitative research (Bryman, 2012). According to Guba and Lincoln (1994), that is because of the underlying assumption of quantitative criteria, namely that there is a single and objective truth that is 'out there' and is waiting to be revealed. This opposes the assumption of qualitative research, namely that there is no such thing as a single and objective truth. Rather, multiple accounts of the 'truth' can be possible (Guba, 1981; Bryman, 2012). Therefore, in order to apply the assessment criteria of quantitative research to qualitative research, they should be redefined (Golafshani, 2003).

This has led to four criteria that assess the 'trustworthiness' of qualitative research: credibility, transferability, dependability, and confirmability. Credibility is closely related to the internal validity of quantitative research, which concerns the question if a study "measures or tests what is actually intended" (Merriam, 1998, p. 64). The qualitative version of this criterion, credibility, concerns the congruence of the research findings with reality (Merriam, 1998). There are several techniques to ensure credibility. The first is respondent validation, which entails returning to the research participants to confirm that the researcher has correctly understood the social world of the participants that was studied (Bryman, 2012). The second is triangulation, which entails "using more than one method or source of data in the study of social phenomena" (Bryman, 2012, p. 392). Respondent validation as well as triangulation can add to crosschecking particular findings and so ensure congruence between the research findings and reality (Bryman, 2012). Respondent validation was ensured by sending the transcript-quotes and their interpretations to the respective interviewees to check if the quotes were correctly interpreted by the researcher. Unfortunately, only half of the interviewees responded. Triangulation was ensured by using two types of qualitative data: primary and secondary data (Bryman, 2012).

The second criterion of trustworthiness is transferability. This is closely related to the external validity of quantitative research, which is the extent to which the findings of one study can be generalized to a bigger population of people or situations (Shenton, 2004). The qualitative version of this criterion, transferability, is concerned with "the extent to which the findings of one study can be applied to other situations" (Merriam, 1989, p. 39). The current research ensured this by providing a thick description (i.e., detailed account) of the context or (social) setting of the

research. This description can leave the choice to others if the research findings are transferable to other settings (Bryman, 2012).

The third criterion of trustworthiness is dependability, which is closely related to the reliability of quantitative research. Reliability is the extent to which a research should yield the same findings if it was to be repeated in the exact same way. This is difficult to accomplish for qualitative research, because of the changing nature of the social phenomena under study (Shenton, 2004). Still, researchers can provide a detailed description of the research process to ensure dependability. This enables others to at least repeat the work, and "if not necessarily to gain the same results" (Bryman, 2012, p. 71). The current research ensured dependability by providing a detailed description that contains the research design (and actual implementation), a detailed description of the data collection and a reflective appraisal of the research process (Shenton, 2004).

The final criterion of trustworthiness is confirmability. This is closely related to the objectivity of quantitative research. Confirmability concerns the extent to which the data confirm the findings (Guba & Lincoln, 1994). In other words, it is the extent to which other researchers would get to the same findings from the data (Baxter & Eyles, 1997). The current research ensured confirmability by applying triangulation in sources of data and by practicing reflexivity by using a reflexive journal during the process of data collection and analysis. This reflexivity entails attempting to uncover one's underlying assumptions about the nature of the research and the context of the research (Guba & Lincoln, 1994).

3.6 Research ethics

In order to ensure the integrity of the practices in the current research, it is useful to discuss ethical issues that might arise during research processes. While there is no consensus on the type of ethical issues that might arise during social research, they are usually broken down into four categories, described by Diener and Crandall (1978): harm to participants, lack of informed consent, invasion of privacy, and deception. The first three categories are mainly applicable to conducting interviews, because this is the only data collection method in the current research that involved actual people. As will be explained later, the deception category is applicable to the whole research process. The four categories will now be discussed in detail to explain what they entail and how the current research managed them.

The first ethical category, harm to participants, entails physical as well as psychological harm such as stress and loss of self-esteem. Researchers are expected to minimize the disturbance

of the research participant itself and the relation of that participant with its environment. The main way to assure no harm to the research participants is by securing the confidentiality of the research records (Bryman, 2012). The current research ensured this by presenting the interview transcripts in a way that the interviewees cannot be identified. As such, names were replaced with the letter 'X'. Also, the detailed description of the interviewees' professional background was done in such a way that these people cannot be traced on the basis of their experience.

The second ethical category, lack of informed consent, entails the extent to which participants are fully informed prior to the research about the nature of the research and potential implications for them. Researchers are responsible for providing participants with a comprehensive explanation of the research in which they participate. This should be an explanation that is understandable to the participants and that should tell them "what the research is about, who is undertaking and financing it, why it is being undertaken, and how it is being promoted" (Bryman, 2012, p. 139). The interviewees of the current research will be sufficiently informed prior to the interviews by providing them enough information to know what the research is about, who is undertaking it, that it is independent of any financial sponsorship, and that it is presumable that the final research paper will only be promoted within the Department of Business Administration of the Radboud University. This information was told to the interviewees prior to the interview and can be seen in the introduction of the interview guide in Appendix 2. When these participants were informed, they were asked if they understood everything that was told to them. If so, the interview would start. If not, further explanations were given.

The third ethical category, invasion of privacy, entails the degree to which invasions of privacy can be tempered. This is closely related to informed consent, because informed consent enables participants to refuse answering particular questions. In the current research, this is respected and so participants could reject invasions of privacy if they felt the need to do so. The final ethical category is deception, which entails representing a research to participants as 'something other than what it is" (Bryman, 2012, p. 143). One common reason for doing so is that researchers often want to limit their participants' understandings of the research in order to let them react to the research setting as natural as possible. This will not be a problem for the current research, because there is no experimental treatment or setting that has to be controlled. As such, the participants were sufficiently and honestly informed about the nature of the research.

4. Findings

In this section, the findings of the current research will be presented. Analysis of the data led to the identification of four phases in the introduction and evolution of CRM in commercial aviation, with each phase having its own characteristics. Each phase is described in terms of evolution of CRM and the promotion and resistance that came with it. The phases in evolution of CRM are as follows, in chronological order: the increased awareness of human factors, the introduction of CRM, the assessment and recruitment on CRM, and the regulation of CRM. For an overview of these phases, see Table 2. It should be mentioned that these phases are analytical phases, meaning that they are a perspective to look at the data. Most of these phases can be characterized by their own specific events and ways of promotion and resistance, and, therefore can be identified as separate phases.

Table 2. Overview of the four phases of CRM-evolution in commercial aviation.

Phase	**General description**	**Explanatory mechanisms behind promotion and resistance**
1. The increased awareness of human factors	From the mid-'70s, the industry began to notice that human error became the biggest factor in aviation accidents, instead of technical deficiencies.	Promotion of tackling human error consisted of mentioning it as the 'new' main cause of aviation accidents, instead of technical deficiencies, and advocating for doing something about it. Federal accident investigation created the basis for this promotion. Subsequently, regulatory bodies were the main promotors. Resistance was aimed at the psychologists that entered the industry, as their new, nuanced way of thinking was not received well by the industry.
2. The introduction of CRM	From the end-'70s, the industry specified what human error entailed. As a solution to these problems, CRM got introduced.	Promotion of CRM consisted of mentioning the percentage of accidents that was caused by human error, and then mentioning CRM as the solution to this problem. Here, federal agencies, regulatory bodies, and airlines that were involved in major accidents were the main promotors of CRM. Resistance mainly came from the old-generation pilots that did not accept CRM.
3. The assessment and recruitment on CRM.	From the end-'80s, the industry showed a growing need for assessing CRM-skills among their pilots. Also, airlines began to recruit pilots with skills that suited CRM.	Promotion of CRM consisted of the publishing of guidance material by regulators that explained how to adopt and assess CRM. Also, beneficial insights of CRM-training were used as a promotion. Resistance to CRM decreased substantially by recruiting pilots that possessed CRM-skills.
4. The regulation of CRM	From the end-'90s, CRM became regulated by the European as well as the U.S. regulators.	Promotion of CRM mainly consisted of the regulation of CRM by regulators in Europe and the U.S. Resistance was passive in nature, because most airlines solely did the minimum of what was regulated, nothing more.

4.1 The increased awareness of human factors

In the mid ’70, before CRM was ever mentioned, the commercial aviation industry began to notice that human error in the cockpit had become the biggest factor in aviation accidents. Take, for example, a description by a senior captain at Transavia (Interview transcript, p. 92):

> *(…) in the ’60, ’70, when airplanes were technically not okay, many airplanes fell out of the sky simply because systems, engines, or whatever, dropped out. At a certain moment, those airplanes improved, and still the accident rate did not decrease enough. So, that is when people said: how is that possible? We have safer airplanes, so it [the accident rate] should be somewhere around zero. However, that turned out to be a utopia, because humans were still in that loop. And humans have the tendency to make mistakes.*

Finally, an article in the New York Times (June 23, 1980) stated it as follows:

> *The public perception that most aviation mishaps result from equipment failure or bad weather is partly based on old movies in which superhuman pilots safely landed crippled or weather-battered planes. However, in recent decades, as new, more reliable jets and operating systems have made air travel much safer, the importance of the human element in accidents has become all too apparent.*

This shows the general technological evolution of the commercial airline industry. Because airplanes improved substantially, they increasingly did not crash because of technical deficiencies anymore. Instead, people started to notice that another factor began to surface: the human factor. As a senior CRM-trainer pinpointed it (Interview transcript, p. 150): “*In the beginning, airplanes sucked. So, you do not even have the chance to make a human error, because that thing just breaks down. When airplanes began to improve, the proportion of human factors-related causes increased by definition*.” In other words, when airplanes began to improve substantially, accidents still happened. This startled the industry, because they thought they had tackled the main problem: technical deficiencies. Instead, another factor surfaced, which was the human part in the system. And that human could make mistakes.

This insight did not just appear out of thin air. Rather, it was caused by (the accident investigation of) particular accidents. Besides some smaller accidents, two accidents in Europe and the U.S. played a significant role in raising awareness about the part of human factors in aviation

accidents: the major KLM crash in Tenerife in 1977 and the United Airlines crash in Portland in 1978. While the major accident in Tenerife had the biggest role in raising this awareness, the accident in Portland was mentioned more often than other accidents. In order to provide an illustration of this accident, take this illustration by the Washington Post (November 28, 1988):

> *United pioneered new training techniques after the airline experienced an accident in Portland in 1978 that became a textbook case on pilot error. A three-pilot crew, preoccupied with a malfunctioning landing gear [focusing on a single lightbulb], allowed a DC8 to run out of fuel while circling the Portland Airport for an hour. Ten of the 189 on board were killed in the crash.*

As such, the accident in Portland had substantially less casualties than the accident in Tenerife. Still, both accidents were solely caused by human error. Take, for example, how a senior CRM-trainer described this (Interview transcript, p. 144):

> *The funny thing is, (...), those are the two most important lessons from those two accidents. Tenerife was about speaking up, right? Two persons in the cockpit, knowing almost certainly that they will cause the biggest crash ever, and still no one says something. So, then speaking up is the subject. And the UA-173 [United Airlines accident in Portlant] is about the division of tasks, right? The fact that everyone starts looking at a particular light means that there is a real chance that no one sees the petrol gauge. Well, that really is regrettable (...).*

Similarly, a former human factors expert at KLM said the following (Interview transcript, p. 113):

> *So, then you see that the human factor comes forward. And then you unfortunately need something big, (...), to say: we really need to do something about that. There is always a small group of people that says: that is interesting. But then nothing happens. Well, for KLM that was Tenerife. That was clearly a human error in communication, hierarchy, leadership style, you name it. So, that was a wake-up call for the world.*

These quotes illustrate the increasing awareness in the industry of the role of human factors in accidents. The revealing effect of the accidents in Tenerife and (later on) in Portland seems to lie in the nature of these accidents, as they were solely caused by human error. Because the part of

human factors in these accidents was so evident, the first actors in the industry started advocating to do something about this problem.

4.1.1 Promotion. Initially, this promotion mainly came from actors from the U.S., from organizations such as the NTSB, ICAO and NASA. At the time of the major accident in Tenerife, the NTSB recognized that their accident investigation should pay more attention to the role of human factors – often referred to as *"the last frontier in aviation"* by fanatic promotors such as FAA scientist Clayton Foushee in the New York Times and NTSB psychologist John Lauber in the Washington Post. As such, an article in ALPA's Flying Magazine (May, 1981) reported the following:

> *The National Transportation Safety Board is also well on the road in establishing a broad aircraft-accident database to shed light on human factors essentially ignored in the present data system. A lack of human factors accident data, in fact, has precluded meaningful response to certain repetitive problems.*

This quote illustrates an important happening in commercial aviation. It was only through the accident reports published by the NTSB that the awareness of human error as a cause of aviation accidents increased. When the NTSB's accident investigation began to notice that human error began to get the upper hand as the cause of most aviation accidents, they began to systematically shed light onto the human factor in their accident data system. So, accident investigations played a significant role in raising awareness about human error in the cockpit.

The shift in focus from the NTSB, from technical deficiencies to human factors deficiencies, was the precursor of the industry's insight that human error was a main contributor to the accidents that took place at that time. One of the first promotors for tackling this problem were the regulatory bodies. Take, for example, what a former administrator of the FAA said in ICAO's Human Factors Digest (1989): *"We spent over fifty years on the hardware, which is now pretty reliable. Now it's time to work with people."* Similarly, an editor in the same magazine (1989) promoted it as follows:

> *The recognition that basic human factors education was needed throughout the industry, (…), was tragically emphasized when, at Tenerife in 1977, two aircraft collided, with a loss*

> *of 583 lives, a disaster resulting almost entirely from a series of deficiencies in the application of human factors.*

Besides the regulatory bodies, other actors in the industry started with promoting to tackle the problem of human error as well. Take, for example, a quote by United Airlines' vice-president for flight standards and training in the Washington Post (September 12, 1982): *"We've spent 30 to 40 years teaching people how to use systems, but we've never gotten into the part that's just as important, the people who fly the planes".* Similarly, an editor in Flying Magazine (May, 1991) promoted it as follows:

> *It's completely invisible, odorless and tasteless. It's responsible for 60 to 80 percent of airline accidents. (...). We have met the enemy, he is us. (...). Human factors is now recognized as the leading cause of airline accidents.*

He calls the Tenerife as one of the major human error-related accidents. As a solution, he says: *"We must train and test in these sophisticated aircrafts as a team."* So, because of the relatively short interval between the accidents in Tenerife and Portland and their accident investigation, regulatory bodies as well as other actors in the industry started with the promotion of tackling human error in the cockpit. According to them, this could be done by shifting the focus of pilot training from technical skills to the 'soft' skills.

In general, initial promotions mainly took place in the U.S., and was focused on a shift in focus from the technical side of flying to the human factors side of flying – as airplanes became more reliable, but humans did not. The actors that promoted this message all profited from the accident investigations of the NTSB, because once the NTSB started to systematically shed light on human factors in its accident investigations, other could see (and utilize) that too.

4.1.2 Resistance. At the time of the raising awareness of the role of human factors in aviation accidents, the industry had a strong blame-culture. In such a culture, pilots could be blamed for every small mistake they made. As a result, this was not the type of culture in which you would admit your mistakes in order to learn from it. Take, for example, a statement of a senior CRM-trainer (Interview transcript, p. 154-155):

> *The difference is, when we started, you really had a blame-culture. If an airplane fell out of the sky in '76, they would see who the captain was. Well, then it was you who had done it. It was as simple as that. (...). It was very closed [the culture]*.

This closeness seems to be a direct result of the blame-culture. If you tell someone about your mistakes, they could make sure you would become the one to blame. So, pilots kept this for themselves. Take, for example, a quote of a former human factors expert at KLM (Interview transcript, p. 123):

> *In aviation, everyone has his own thing. I am responsible for this part, I am trained for that part, and I am assessed on that part. I live in some sort of cocoon. (...). You could see that in the cockpit too.*

In other words, the culture in commercial aviation was a blame-culture, meaning that you could be blamed for every mistake you made and, as a result, people did not really communicate with each other. As a result, even if pilots knew or experienced human factors-related problems, they would not be the ones to disclose that.

At the time of this industrial culture, pilots, and especially captains, had a very specific personality. Most of these pilots flew in the military before they started working in the commercial airline industry. Instead of consulting the co-pilot, such captains would tell the co-pilot: "*just look out the damn window. (...). I'll do what I want"*, as stated in a report published by NASA (August, 1984). Take, for example, a description from the New York Times (March 27, 1988): *"Traditionally, the captain is king in the airliner cockpit. (...). Particularly some older pilots who began in the military, brook no interference for the juniors"*. Also, a senior captain at Transavia described these pilots as follows (Interview transcript, p. 98): *"They were little despots, so to say. Like: guys, you listen to me and apart from that, I absolutely do not care about your opinion."* All in all, these captains were very authoritarian and were used to working in a very hierarchical organization. And so, these captains were the absolute ruler in the cockpit, not tolerating any input from others.

These pilots strongly resisted the attention that was given to human factors. This was closely related to the psychological aspects of these human factors. This new perspective welcomed psychologists and their soft approach into commercial aviation, to the displeasure of many. Take, for example, an engineer in Aviation Week (September 5, 1977): *"Let's get system safety into*

accident prevention and the psychologists out". Similarly, a NASA scientist illustrated this resistance as follows in the New York Times (April 1, 1987): *"Advocates of such training have struggled to win over a skeptical pilot force. The initial suspicion among pilots was that it was some kind of charm school; that you had it in a hot tub holding hands, (...)"*. According to ICAO's Human Factor Digest (1993), these skeptical pilots would say that *"human nature cannot be changed".* Clearly, many pilots were dissatisfied with the fact that psychologists entered the industry to try to deal with the problem of human factors.

This resistance was closely related to another characteristic of commercial aviation at that time. Back then, the approach to aviation technical and straight in nature, which was clearly illustrated by one of Boeing's psychologists in the Washington Post (November 28, 1988):

> *Aviation is a conservative business, run by engineers and business executives, who are far more comfortable dealing with cause and effect. Accident X was caused by the failure of System Y. (...). We don't know why a human being makes a mistake. It's much easier to analyze a mechanical airplane than the human mind.*

Similarly, a NTSB psychologists described it as follows in the New York Times (August 26, 1987):

> *Until very recently, (...) "soft" scientists like himself (...), were not particularly well regarded by the "hard" scientists in such disciplines as aeronautical engineering and avionics. To them, the human factor was an unquantifiable and therefore uncontrollable variable and, (...), technology seemed bound to eliminate such performance problems.*

In other words, things were seen as black or white, not grey. This opposes the psychological approach of human factors, which was less easy to measure and more about nuance. As a result, the psychologists that entered the industry were often put away as softies that tried to change the personalities of pilots.

Finally, another type of resistance was closely related to specific personality trait of pilots. Take, for example, what an employee of the FAA stated in the Washington Post (November 28, 1988): *"Many people are uneasy with human factors. It questions things like judgement and leadership in the cockpit."* This seems to be the result of a strong feeling of honor and pride about their profession. When people started to promote human factors training for pilots, most pilots took this as very personal critique. Take, for example, how a senior CRM-trainer described the general

reaction: *"Like, do you think we cannot fly? Like that. (...). Really dishonored."* (Interview transcript, p. 154). Also, an ALPA-member stood up for his colleagues by arguing the following in the Washington Post (September 12, 1982):

> *Guys are not, contrary to what FAA would have you believe, flying around with their white scarves hanging out their windows and would not fly under the Golden Gate Bridge if they could. (...). Guys are not deliberately taking airplanes off and risking passengers' lives and their own lives.*

Taken together with their feelings of honor and pride, this often resulted in emotional reactions when someone else had something to say about their profession, especially with regard to human factors. As such, aviation in general and especially pilots strongly resisted the attention that was given to human factors in the first phase. This resistance was closely related to the dominant culture and pilots' personalities at that time, as this respectively was technical and straight, accompanied with strong feelings of honor and pride.

4.2 The introduction of CRM

As the attention for human factors began to grow, more and more attention went out to train pilots on the utilization of the resources available to them. This was formally addressed in a conference organized by NASA in 1979 in the U.S. From there, cockpit resource management was born. Take, for example, the general message of that conference stated in an FAA document (August, 1993):

> *CRM grew out of the recognition that the majority of aviation accidents and incidents were attributed to the ubiquitous root cause 'human error'. However, closer inspection revealed that the principal contributor to human error accidents was the failure of crew members to utilize all of the resources available to them and to perform effectively as a team (...).*

Also, an article in the New York Times described this introduction as follows (March 27, 1988):

> *Two- and three-man airline flight crews, aviation psychologists are discovering, often don't work well together. To correct this, they are urging changes in training procedures. One of the new concepts they [NASA] have introduced is an approach called cockpit resource management.*

These quotes illustrate the insight that a big part of human error in the cockpit was due to bad use of the (human) resources available in the cockpit and inadequate crew coordination. By organizing their conference, NASA was the first to officially name and promote cockpit resource management training as the solution for these problems during their conference in 1979.

As mentioned previously, the major accident in Tenerife and the accident in Portland had human error as the evident cause. Also for the general public, it became clear that the worst accident in aviation history (i.e., in Tenerife) and the accident in Portland were caused by human mistakes, instead of a technical malfunction of the airplane. As will be explained later on in this section, this made it impossible for the involved airlines to look away. As a result, KLM as well as United Airlines were the first to develop their own CRM-training, respectively in Europe and in the U.S. Take, for example, how a senior CRM-trainer described this development (Interview transcript, p. 143):

> *Actually there are two main players with two occasions that happened relatively simultaneously. We had Tenerife and they had that bulb [the United Airlines crash] so to say. That has been the motive for them. If you slam into the ground in front of the crowd, well, that makes a difference. (...). Then you have to say: we have got the solution: CRM-courses! The commercial interests are just very large.*

A senior captain at KLM stated it as follows: *"The crash in Tenerife has practically been the reason for KLM to break with the usual. That the captain could take decisions like some sort of a king."* Similarly, a former human factors expert at KLM described it as follows in one of the interviews (Interview transcript, p. 127-128):

> *KLM, (...), had the enormous burning platform of Tenerife. That should never have happened! (...). It is all about reputation and image. People need to dare to fly with you again. You should have the feeling that they do everything to keep it safe.*

These quotes illustrate the general notion that accidents such as in Tenerife and Portland left the directly involved airlines no choice but to change course. According to a senior CRM-trainer, the part of human error in these accidents was *"that visible, that you could not deny it anymore"* (Interview transcript, p. 155). Furthermore, major accidents are bad for business, because they receive a lot of attention by the general public. In commercial aviation, these people are your

customers. So, if you want to survive as an airline after having an (major) accident like the ones in Tenerife and Portland, you do not really have a choice but to do something to improve your safety. In commercial aviation, reputation is key, so you need to show your customers that you are safe to fly with and that you can be trusted. How some airlines did this will be clearly illustrated in the promotion section if this phase.

Other airlines did not have major crashes, and so not every airline initially felt the need to develop their own CRM-training. They seemed to make a trade-off for themselves. For example, a former human factors expert at KLM described it as follows (Interview transcript, p. 127):

> *There needs to be a sufficiently burning platform, really. That sounds very negative, but what is the necessity to change? (...). So, as an individual but also as an organization you actually make a trade-off. So you say: what is in it for me if I change? (...). Airlines can say: we never had an accident. It is all going well, so.*

Or, as a senior pilot at Transavia put it in one of the interviews (Interview transcript, p. 99):

> *It differs per organization. Look, KLM has got money to hire expertise for their organization. However, you should notice that most of the airlines, and even the bigger airlines, (...), will never hire expertise for their organization, of course.*

In a similar manner, an employee of the NLR and the HUFAG said the following in one of the interviews (Interview transcript, p. 180): *"(...). That is a continuous balance of: going for quality or going for efficiency. That plays a major role everywhere, but especially in aviation."* These quotes seem to illustrate that, at the time, many airlines in the industry saw no need to improve their quality (i.e., adopt CRM) when they were not involved in a major accident. Instead, efficiency was deemed more important, and so CRM would not be adopted. So, also because of commercial interests, not every airline developed their own CRM-training during this phase, as it was not mandatory and often too expensive to develop it from scratch. This reflects that the need for CRM could be seen as a company-specific problem, instead of an industry-wide problem. After all, why change if everything goes well?

4.2.1 Promotion. As mentioned before, NASA was the first to officially mention CRM as the solution to human error in the cockpit. It did so by organizing an international conference in 1979. The approach of the conference was described as follows in its report (March, 1980):

> *(…) one of the principal causes of incidents and accidents in civil jet transport operations is the lack of effective management of available resources by the flight-deck crew. It is further argued that the present aircrew training programs could be augmented to improve flight-deck management.*

During this conference, CRM was introduced as the solution to the ineffective management of the available resources in the cockpit. After NASA introduced CRM, other actors started to promote it as well. Just as in the first phase, this promotion mainly took place in the U.S. Take, for example, a quote of the head of the Pan American flight academy in the New York Times (April 1, 1987): *"As planes become more and more reliable, we need to train airmen on the human resources available to them."* In the same breath, the solution for this ineffective coordination would be named as CRM. Besides this general promotion of dealing with the ineffective coordination of the resources in the cockpit, in many other promotion texts the following order of promotion is used. First, they name the percentage of accidents that is caused by human error, or they name specific textbook case accidents like the major accident in Tenerife. Second, they provide the solution for preventing such accidents to happen, which is always CRM. Take, for example, a quote by an editor in ALPA's Flying Magazine (May, 1991):

> *(…) the United DC-8 fuel exhaustion accident in Portland, Oregon, and the worst airline crash in history – the runway collision between two jumbo jets at Tenerife, Canary Islands – each had human factors as a primary ingredient. Listening to the cockpit voice recordings leaves me cold and dry-mouthed.*

In light of this statement, the editor discusses CRM. Similarly, an anonymous letter in Aviation Week (March 12, 1990) said:

> *For at least the last 15 years, more than 60% of all commercial fatal accidents have had, as one cause, poor management of the resources available to the cockpit. Recognizing this, Cockpit Resource Management training (CRM) is today the focus of many aviation interests.*

Also, an editor in the New York Times (March 27, 1988) stated the following:

> *One of the new concepts they [aviation psychologists] have introduced is an approach called cockpit resource management, which teaches pilots to work together so that an unexpected cascade of small problems on a flight doesn't escalate into a catastrophe.*

This type of promotion differs from the previous phase, in which actors mainly promoted to do 'something' about the human error in the cockpit. At the time, they seem to not know what should be the solution. Also, the human factors accident database needed to be developed first in order to generate statistics that can be used for the promotion for CRM. In the current (second) phase, human error was defined in detail and NASA and other actors introduced and promoted the solution to this problem: CRM. The accident in Portland and especially the major accident in Tenerife clearly added to this promotion, because they were textbook cases for illustrating how human error could have disastrous consequences.

Besides general promotion for adopting CRM, particular airlines started the promotion of their own CRM-development. As mentioned before, airlines that were involved in major accidents, with human error as the main cause, had to take action in order to restore their customers' trust in their company. In an attempt to do so, some airlines publically showed their interest for tackling the problem of human error. According to a senior CRM-trainer, this was a clear example of *"window dressing"* (Interview transcript, p. 153). Take, for example, a statement by United Airlines' vice president for flight standards and training in the Washington Post (September 12, 1982):

> *"United's program stresses that two or three heads working on a problem are likely to arrive at a better answer than one head resisting or not hearing suggestions from others. We can't change personalities, but we can change the ways crew members operate with each other (...).*

Also, Figure 3 shows an advertisement of United Airlines that was published in the same year as the previous quote. Clearly, United Airlines did an attempt to show the public that they did their best in solving the problem of human factors by developing their own CRM-training. All in all, the airlines that were involved in major accidents played an important role in the promotion of CRM. Instead of the other actors that promoted CRM in this phase, these airlines had a specific motive: showing the public that they did an attempt in tackling the problem of human error.

4.2.2 Resistance. As mentioned earlier, most airlines initially did not adopt CRM. While not in its direct form, this can be seen as (passive) resistance. Several actors in the industry promoted adopting CRM, and still most airlines did not do so. The reason for this was already discussed. While most of these airlines did not openly react to the new movement of CRM, they did not adopt it. As such, it can be seen as a passive form of resistance.

Within the airlines that did adopt CRM and started to train their pilots, it slowly became clear that some pilots would never accept CRM-training as the right way to go. These, often older-generation, pilots are referred to as 'boomerangs', 'cowboys' or 'drongos' in the data. As an editor in ALPA's Flying Magazine (May, 1991) put it: *"You'll never get ol' John to do all that airy-fairy crap. He's a crusty old guy and he'll die with his boots on"*. As an illustration of these type of pilots, see Figure 4. A senior CRM-trainer described it as follows (Interview transcript, p. 143): "*CRM means holding yourself accountable, saying why you do things, receiving feedback from other on your behavior. Well, most men, initially did not feel anything for that."* According to a senior captain at Transavia, these pilots would *"just not listen and said: guys, it is fine. I do not care"* (Interview transcript, p. 98). This type of resistance seems to be less emotional than the resistance of the previous phase, which could be the result of the lack of assessment of CRM at the time. Instead, the 'cowboys' could undergo CRM-training and walk out the door without ever applying it in practice. Without assessment, no one would ever find out.

Figure 3. Advertisement of United Airlines in Aviation Week, 1982.

So, within the companies that developed its first CRM-training, it was difficult to persuade their pilots. This was not only the result of a stubborn, old generation of pilots, but was also the result of the abstract and theoretical approach of the CRM-trainings. Take, for example, a former Human Factor expert at KLM that got this insight during the first trainings: *"To get it [CRM] out of psychology and the vagueness, make it very specific. It is, by all means, a target audience that loves specific things. So, when you fly, you fly two knots too fast. (...). That is tangible (...)."* (Interview transcript, p. 116). Or, as a senior captain at KLM put it (Interview transcript, p. 41): *"So, content wise those trainings were quite okay, but not made specific at the practice of flying. Too little specific."* Also, a senior captain at KLM said the following (Interview transcript, p. 82):

> *It is not concrete, it is not technical. It is no manly language, to put it a little exaggerated. Pilots are, of course, 'doers' and are focused on solutions. And then this, well, lubricating oil [metaphor for CRM]? For me, that is clear. But someone who does not speak that language could say: lubricating oil, do not bother me with that. You either do it right or you do it wrong.*

Finally, an editor in Aviation Week described it as follows (May, 1991): "*As I learn more about CRM, I realize there is very little black and white; rather, there are varying shades of grey, all*

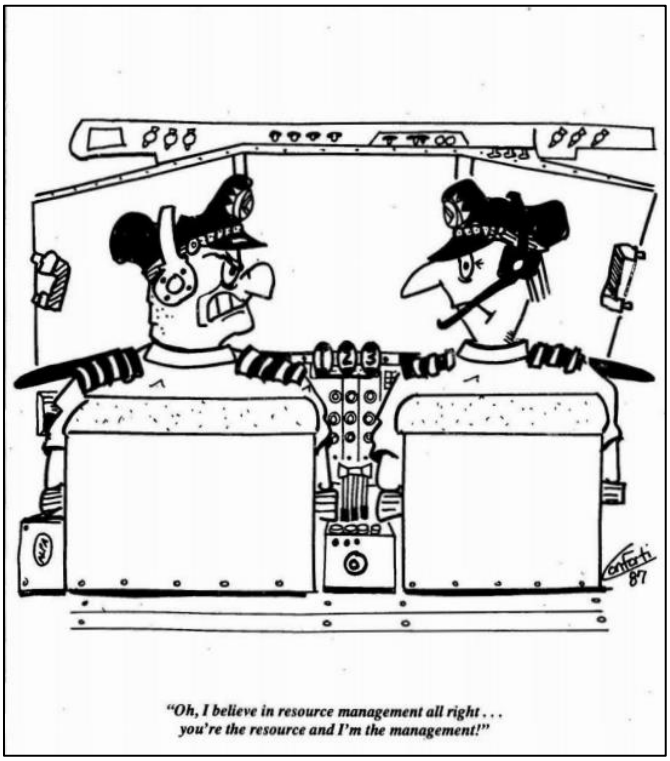

Figure 4. Cartoon of the macho-pilot and CRM in ICAO's Human Factors Digest, 1989.

overlapping and connecting with each other." Just like the first phase, pilots resisted the softness and vagueness of the concept of CRM. In the current phase, this type of resistance was also experience during the first CRM-trainings. This was not only the result of the pilots' personalities, but also due to the content of the trainings. Again, it was not concrete or tangible, nor was it applied to the practice of flying. So, there was still a lot of work to do with regard to the resistance to CRM.

4.3 The assessment and recruitment on CRM

The third phase in CRM-evolution can be characterized by a growing interest for the assessment of CRM. There was a growing need within the industry to evaluate the effects of CRM-training on the flight-deck crew. Take, for example, how a senior CRM-trainer described this need (Interview transcript, p. 159): *"Once I have implemented CRM, I want to take a random flight instructor and let him grade someone in an objective way."* Especially the last point was difficult to accomplish, because assessing someone on CRM-skills was not as clear-cut as assessing someone on his flight speed. In an attempt to concretize this assessment, the JAA asked several research institutes in Europe to do research on how to systematically assess on CRM-skills. Accordingly, these institutes developed NoTechs, which was an assessment system for CRM. While this framework was statistically supported, it was developed relatively late. Most of the major airlines already developed their own CRM-training and some airlines even integrated this into their general pilot assessment. Within Europe, KLM was the first to integrate non-technical skills, the skills that are taught by CRM-training, into their pilot assessment. Central to this assessment system was a framework called SHAPE, which is a systematical language to describe language and behavior. Take, for example, the description of SHAPE by a former human factors expert at KLM (Interview transcript, p. 119):

> *(…) So that is a completely integrated whole. (…). And that provides you with something beautiful in which you make a connection between technical flying skills and non-technical skills, as it is called. Those two influence each other and I can observe and assess them.*

Also, a senior captain at KLM described SHAPE as follows (Interview transcript, p. 35)*: "With SHAPE, (…), we have the ability to, during exams, to assess people on non-technical skills, while the legislator never did that."* While these quotes originate from (former) employees of KLM and so may be biased, they still illustrated the integration of CRM into the assessment method. More specific, with the use of SHAPE, assessors can objectively assess and describe someone's technical

and non-technical skills. With SHAPE, KLM was the first to make an attempt in integrating non-technical skills into their assessment system and to objectively describe and assess one's non-technical skills.

The third phase can also be characterized by a change in meaning of CRM, as it changed from *cockpit* resource management to *crew* resource management. This reflects the change in focus with regard to the people that should receive CRM-training. At a certain moment in time, actors such as regulators and psychologists started to look beyond the cockpit. Pilots do not work alone and others, like the cabin crew, could possess useful information for safety ends. Take, for example, the description of this evolution by a former human factors expert at KLM (Interview transcript, p. 114-115):

> *So, at first, you had the captaincy course. Shortly after, the first officers joined. And then they said: for all flyers, so also the second officers. Those joined. (…). And then they said: it is also about the communication between cockpit and cabin, you know? So, actually, you see an expansion of the 'crew'.*

Similarly, a senior captain at KLM described this development as follows (Interview transcript, p. 79): "*It started with the cockpit. At a particular moment in time you learned that there is something behind that door too. And that is also part of our team. So, cabin crew was also involved."* So, during the third phase, CRM-training started to focus on the cockpit crew *and* the cabin crew, because the cabin crew is also part of the flight deck crew and might be a source of useful information to improve safety. In this way, the scope of CRM expanded.

4.3.1 Promotion. At the beginning of this phase, more and more airlines began to adopt CRM. This was partly caused by guidance material that was published by the FAA in the U.S. and the CAA in Europe. These documents are thick descriptions of what CRM entails and how airlines can adopt it. Take, for example, the description of the CAA's guidance material by an employee of the NLR and the HUFAG (Interview transcript, p. 201):

> *"The CAA does that, for example, in the field of CRM. CAP, I think that is the abbreviation for Civil Aviation Publication, 737. (…). For years, that has been the document, of at least 120 pages, that tells you what CRM-training is, how you can teach it (…).*

Similarly, this is what the FAA's guidance material (August, 1993) states as the purpose of the document:

> *This advisory circular (AC) presents guidelines for developing, implementing, reinforcing, and assessing Crew Resource Management (CRM) training programs for flight crewmembers and other personnel essential to flight safety. These programs are designed to become an integral part of training and operations.*

This guidance material enabled airlines to adopt CRM without having to develop it themselves from scratch. In other words, airlines that did not adopt CRM, because of the high cost of developing it, could now adopt it relatively cheap. As a result of this material, more and more airlines began to adopt CRM. As such, regulators in Europe as well as the U.S. played an important role in the large-scale adoption of CRM.

In trying to persuade airlines to adopt CRM, others attempted to promote it by providing examples of pilots that were happy to have learned from the training. Take, for example, a quote by a senior captain at United Airlines in the New York Times (April 1, 1987): *"It's taught me to ask the opinions of my crew and listen more."* Similarly, a CRM-trainer stated the following in the Washington Post (September 12, 1982) about a training session: *"We were running a tape recently, and the first officer told me to stop it. He turned to the other crew members and said, 'My God, do I come across like that?' They told him he sure did."* To take it one step further, the FSF's Flight Safety Digest (November, 1990) stated the following:

> *One corporate pilot said of his CRM training, "one thing that I see is that I have not given up my authority, and in fact, it has enhanced my authority. The trip goes a lot better because they [other crew members] feel more comfortable bringing forth input, and they don't have to do it in an aggressive, ticked-off manner".*

These quotes specifically show how pilots improved their way of working by participating in CRM-training. So, by specifically showcasing the beneficial outcomes of CRM-training on airlines' operations, actors tried to persuade airlines to adopt it.

Besides the promotion of CRM by the publishing of guidance material, some actors started with advocating for regulations. For example, an editor in the Washington Post (November 28, 1988) wrote:

> *The Federal Aviation Administration (FAA) has known for more than a decade of pilot training techniques to encourage pilots to act as a team to guard against blunders by an individual. But the agency has taken only tentative steps toward requiring airlines to teach it to their pilots.*

Similarly, an executive of a corporation that owns Continental and Eastern Airlines said the following in the context of regulations (November 28, 1988): *"In almost every phase of aviation, we have pushed the frontiers of human knowledge. But we have not pushed the frontiers on human behavior."* So, instead of trying to persuade airlines to adopt CRM, other actors pointed their direction to regulators in order to instill mandatory adoption. In other words, because some airlines still not voluntarily adopted CRM, several actors started to promote regulations in order to force them.

4.3.2 Resistance. While most of the older generation pilots still resisted CRM-training and some airlines also still resisted to adopt CRM into their pilot training as well as assessment, the current phase is a phase were much of the resistance disappeared. This was caused by two developments. First of all, airlines started to teach their own instructors to train in CRM. For long, airlines hired externals to give this training. Take, for example, an illustration by a senior captain at KLM (Interview transcript, p. 41):

> *You know, great theory, but what can I do with it in practice? (...). As a trainer, if you do the same type of work, you can contribute to the training by providing examples from practice (...). That translation, to develop people in this field, can, on a deeper level, only be done by people that work in the same field.*

Similarly, another senior captain at KLM illustrated it as follows (Interview transcript, p. 83):

> *It was the trade-off of providing a three-days training given by educators that have affinity with flying, in other words: external, or by flyers that have affinity with education and instruction. (...). Well, for a while, that has been external. However, what turned out to be of added value time after time, is the in-house training by fellow pilots.* (…). *We are colleagues, and in that atmosphere, we will be sparring with each other about our profession.*

Clearly, providing CRM-training given by fellow pilots instead of externals turned out to be very useful in decreasing the resistance. According to a senior captain at KLM, this was because internal trainers could *"recognized the situation"*, instead of tell *"a theoretical story"* (Interview transcript, p. 83). As such, CRM became very concrete and specific. This caused a substantial decrease of resistance to the vague and theoretical nature of CRM, as mentioned in the first two phases of CRM-development.

The second development that took away a lot of resistance was the outflow of most older-generation pilots, approximately 20 years after the major accidents in Tenerife. These pilots heavily resisted the introduction of CRM, but most of them retired in the two decades after that. Instead of flogging a dead horse in constantly trying to change this generation of pilots, most airlines focused on the pilots that were open to the CRM-training and waited until the older generation retired. Take, for example, how a general aviation expert and former senior captain at KLM described this development (Interview transcript, p. 214):

> *And with the older generation, that was a struggle here and there, of course. (…) Those were known in the community of flyers as the captains with their oddities. (…). Well, that just had to extinct. That cost 10 to 20 years.*

Similarly, a senior captain at Transavia said (Interview transcript, p. 102):

> *"I was 30 when I started at Transavia, and what you could see there is that, slowly but surely, those old men flow out. The postwar generation, so to say. The ones that got me grey hair and caused me to have sleepless nights.*

While, at the backside of most airlines, this older generation pilots retired, the development at the front side of these airlines fostered the pace of the cultural change that was needed to make CRM work. This cultural change will be explained later on, in the fourth phase in the evolution of CRM. At the front side, airlines started with the recruitment of pilots that already possessed the soft skills that CRM-training would normally teach. This insight and development was clearly illustrated in the FAA's guidance material (August, 1993): *"As such, personality traits in the pilot population are not amenable to manipulation by training. Rather, they can be manipulated by selecting for specific traits during the initial hiring process."* Also, a senior captain at Transavia described it as follows (Interview transcript, p. 96-97):

Back then, we said: you just have to be able to fly. If one can fly properly, we hire him. Now we say: well, we assume he can fly, but we want to see if he fits in our company. That is a completely different perspective. (…). We now primarily only look at personality.

So, instead of trying to change the (personality of) pilots that certainly would not change, airlines focused their recruitment on hiring pilots with the right personalities in light of CRM. In this way, you could create a CRM-culture in which the macho-pilot disappeared and made place for pilots that dared to speak-up and communicate freely with each other.

4.4 The regulation of CRM

The fourth phase can be characterized by the phase in which CRM became regulated. Once the science of human factors and CRM substantially improved in the industry as well as with the regulators, CRM became regulated. First, the FAA required CRM-training and assessment in the U.S. in 1998. Shortly after, the JAA required the same in Europe in 2001. According to many, this was a much needed development in the industry. Take, for example, what an employee of the NLR and the HUFAG said about this (Interview transcript, p. 198): *"What really helps with the implementation [of CRM], not so much with the acceptation, is that, (…), it became a worldwide obligation. (…). Of course, then you are still not there yet, but it really helps."* Similarly, a senior captain at Transavia described it as follows (Interview transcript, p. 108):

(…) And that is the importance of regulations. That the regulations indicate: guys, we can haggle about it, but this is the minimum level we demand. And that is what you need the legislator for. When you do not have the legislator, people will absolutely remove it from their program, because at the end of the day it is about the profit and loss statement.

In other words, regulation was much needed to get every airline in the industry to adopt CRM. Even though some airlines that did not adopt CRM just before it got regulated, they were now compelled to do so.

Just as the employee of the NLR and the HUFAG said in his quote about regulations, compelling airlines to adopt CRM-training does not necessarily mean that you are there yet. In order for CRM to work, it has to become an integral part of the organization. However, even airlines that adopted CRM-training way before the regulations had difficulties with fully integrating CRM into their trainings and procedures. Take, for example, how a senior captain at KLM described this

(Interview transcript, p. 13): *"I think that, when you look at CRM, it was already legally required, but it really was a separate part: 'oh, right, we also need to do something with CRM' [like they forgot]."* Similarly, another senior captain at KLM described it as follows (Interview transcript, p. 81): *"At first, is was an isolated thing. Also in training with a couple of briefing items. Then it was about technical this and flying that. (...). Oh, and we also have to talk about CRM for 10 minutes."* Clearly, these quotes illustrate that, even though CRM-training became mandatory throughout the industry, CRM was not yet where it was ought to be: an inseparable part of the organization.

Apparently, this needed time. Slowly but surely, within some airlines, it became more integrated. The data only gave insight into this development in Europe. Take, for example, how a senior captain at KLM described the development (Interview transcript, p. 81): *"It has been much more integrated into the way of briefing. Most of the time, we start with a briefing with a CRM-aspect as the common thread. (...). Which makes it much more integrated."* So, CRM slowly became more and more integrated into the training and procedures. Eventually, CRM reached its full potential: it became fully integrated. Take, for example, how a senior captain at Transavia described this (Interview transcript, p. 102-103): *"You can see a turning point. The whole culture changes, you see? (...). You can see that it [CRM] becomes more and more like a culture."* Also, another senior captain at KLM described it as follows (Interview transcript, p. 10): *"More and more, we try to show people that CRM is not a separate thing, but rather a fully integrated into everything we do. Even in technically flying an airplane."* So, CRM became fully integrated into the training and operations of some airlines, but surely not all of them. Moreover, these quotes illustrate that CRM not only is a way of training, but eventually is ought to be a way of working. In that sense, full adoption of CRM equals a cultural change. Remember that, at the time CRM was introduced, commercial aviation had a blame-culture with a closed and macho character. By the time CRM became fully integrated, this was completely different. Take, for example, how a senior CRM-trainer illustrated this (Interview transcript, p. 154-155):

> *We do not want a pilot to think that he can be sued, because we want to hear his story. And not the story that gives him as little blame as possible. And within the industry, we now reached a point of knowing from each other: hey, you made that mistake, but I could have made it too.*

Similarly, a former human factors expert at KLM described this as follows (Interview transcript, p. 128-129):

> *We do not want to have a blame-culture. We want to have a just-culture. (...). When you make a mistake, it is not you, so to speak, but rather the context you were in that caused it. (...). And that is an important one, because that just-culture actually continued to grow parallel [to CRM] in the industry.*

In the same manner, a senior captain at KLM described it as follows (Interview transcript, p. 84):

> *Actually, that [CRM] develops parallel to a culture in an organization, you see. (...). At KLM, you are invited and dared to share the things you do well, but especially the things that did not went well. There is no punishment for that. Like the just-culture. (...). It once has been a macho-world and that slowly improved.*

So, along with the development of CRM, the culture in commercial aviation underwent a big change too. By learning CRM-skills, pilots became more and more open to each other as they noticed that they would not be blamed for their mistakes. As a result, they could see that everyone, even the much respected pilots, made mistakes. Instead of blaming these pilots for their mistakes, these stories were shared to learn from it. That led to a shift from the blame- to a just-culture. The common thread in this development has been CRM, because it has become a way of working with each other in which hierarchy is taken away and communication is open.

Along this cultural change, the meaning of being a pilot changed too. At first, as described in the first two phases, being a pilot meant having a lot of authority (and using it), having less (safety) rules and a having colleagues that would not (dared to) question your decisions. About 20 years later, being a pilot meant being a manager that worked together as a team, having a more and more safety rules and being open to critique. An editor in ALPA's Flying Magazine described this new standard of pilots as follows (May, 1991): *"They're more receptive to input from others, though still in command of their job. The pilot uses all the resources available, instead of choosing to do it alone."* Or, as NTSB psychologist John Lauber said in the New York Times (August 26, 1987): *"Flying, (...), is becoming quite literally a management job".* So, along with the industry culture, the meaning of being a pilot changed too.

4.4.1 Promotion. Because CRM-training became mandatory for all airlines in the industry, the biggest goal of the promotion in the previous phases has been accomplished. As such, the regulators were the biggest promotor of this phase. From the moment of regulations, the data did not show much promotion in Europe nor the U.S.

4.4.2 Resistance. With the regulation of CRM, a minimum level of CRM-training became mandatory. Even the airlines that did not adopt it yet, were now compelled to do so. However, as often with regulations, many airlines did just the exact minimum and left it at that. This can be seen as a form of resistance, because if these airline truly believed in CRM, they would have done more to really make it work. Take, for example, how a former human factors expert at KLM illustrated this resistance (Interview transcript, p. 115): *"What you see, is that some companies only do the minimum. So, it is really important what you describe in the law. The risk is, (…), that they think: okay, that is ticked. Done. And move on."* Also, a senior captain at Transavia pinpointed it as follows (Interview transcript, p. 99):

> *What is your goal of training? Do you want to comply with the law or do you want to train your pilots well? (…). Because with most small airlines it is solely about pleasing the legislator, so to speak. Because rule number one with training is: comply with the law.*

So, not all airlines incorporated CRM to the fullest. Instead, they often did what was demanded, and nothing more. The reason for this seems to be the trade-off between efficiency and quality, just as during the phase of the introduction of CRM. Instead of deciding to adopt CRM, the trade-off was now about integrating CRM into the organization. According to a senior captain at KLM, there are still many airlines in which *"the integration has not really started yet"* (Interview transcript, p. 39). As such, not all airlines fully changed their culture.

5. Discussion

The current section discusses the most important research findings in light of the literature in order to provide a comprehensive answer to the research question. The discussion of these findings will be done by answering the sub-questions of the current research: *how did CRM, as a new practice, develop in the field of commercial aviation?* And *which theorization efforts regarding aviation safety, and by whom, were made to provoke change in the field of commercial aviation?* Subsequent to answering these questions, the limitations and boundary conditions will be discussed as a reflection on the current research (process). After the discussion, this research paper will end with the concluding remarks and directions for further research.

5.1 The institutionalization of a new practice

The findings show that the development of CRM in the field of commercial aviation is in accordance with the process model of institutional change in the literature (Greenwood et al., 2002). First, the findings show that the institutional change process started with the Tenerife Air Disaster. This is in accordance with the model of Greenwood et al. (2002), as the institutional change process starts with a disruptive event (or *jolt).* Following this event, as attention to human factors began to increase, psychologists entered the field. Their approach to pilot training substantially differed from the dominant approach in aviation at that time. These findings are in accordance with literature on institutional change, as disruptive events are said to be followed by the emergence of new players in the organizational field (Greenwood et al., 2002). These new players are said to destabilize the established practices as they "disturb the socially constructed field-level consensus by introducing new ideas and thus the possibility of change" (Greenwood et al., 2002, p. 60).

Following these two stages, the findings show the early adoption of CRM by two major airlines. The reason for this early adoption was their direct involvement in the respective (major) accidents, which was revealed by the accident investigators. These findings are in accordance with the model Greenwood et al. (2002), as the third stage of institutional change (i.e., pre-institutionalization) comprises only few adopters of the new practice. Also, the findings show that the motive behind this early adoption was to regain their customers' trust. This is in accordance with general institutional theory, as they tried to regain legitimacy – which is defined as "the generalized perception or assumption that the actions of an entity are desirable, proper or

appropriate within some socially constructed system of norms, values, beliefs and definitions" (Suchman, 1995, p. 574). These findings do, however, not correspond with the dominant literature on motives behind new practice adoption, which assumes that early adopters seek technical gains, whereas late adopters seek legitimacy (Tolbert & Zucker, 1983). A more recent study of Carberry and King (2012) can provide an alternative explanation for these findings, in which they showed how accounting firms adopted a newly theorized practice to defend their legitimacy in the field. This type of adoption is called 'defensive adoption', and is said to often be accompanied by "verbal strategies of impression management" (Carberry & King, 2012, p. 1138). Moreover, they showed that defensive adoption had the greatest effect for firms that had been connected to critical problems and/or events. Such firms may lose their legitimacy in the organizational field when the alignment of their practices with institutions are questioned by actors from that same field (Carberry & King, 2012). The research findings are in accordance with this literature, as it was the motive to regain legitimacy in the field of commercial aviation that made KLM and United Airlines adopt CRM in an early stage of its development. Also, publically showcasing their CRM-adoption can be interpreted as a verbal strategy of impression management.

According to Greenwood et al. (2002), pre-institutionalization is followed by the theorization stage. The research findings, however, do not correspond with conceptualizing theorization as a separate stage in the process of institutional change, which will be discussed in detail in answering the second sub-question later on in the discussion section. Following the increasing adoption of CRM, it got regulated. As a result, CRM widely diffused in the field of commercial aviation. This diffusion is in accordance with the model of Greenwood et al. (2002), as the fifth stage of institutional change is said to be characterized by widespread diffusion of a new practice in the field. Also, in a broader sense, these findings correspond with literature on institutional theory. According to Scott (1995), institutions comprise three (analytically) different elements: regulative, normative, and cognitive. Each element defines legitimate organizational behavior differently. With the regulative element, legitimate behavior is seen as meeting regulations. Therefore, adoption of CRM was seen as sufficient legitimate behavior at the time it got regulated.

The findings show that many airlines performed CRM in isolation of other parts of the organization. In other words, these airlines solely did the minimum that was required by the regulations, and so did not integrate CRM into their organization. As such, the motive behind this

kind of adoption seems instrumental. A study of Kostova and Roth (2002) provides an explanation for these findings, as they make a distinction between ceremonial and internalized adoption. With ceremonial adoption, new practices are solely adopted for (regulative) legitimacy reasons. As such, organizations do not believe the new practice to be (economically) valuable to the organization, and so it remains loosely coupled to the other parts of the organization. With internalized adoption, new practices are adopted because it is seen as the right thing to do and so it is integrated in the entire organization. From this perspective, many airlines adopted CRM as ceremonial adoption, instead of internalized adoption, at the time it got regulated.

Still, the findings show some cases of internalized adoption. For example, in some organizations, it got integrated into their recruitment policy. As a result of the integration of CRM, the role structure in the cockpit changed from a hierarchical one to a flat one. Accordingly, pilots were expected to be a team player instead of an authoritarian leader. This is in accordance with literature on institutional theory, with regard to the normative element of institutions (Scott, 1995). This element can be reflected in professions, as similar education and training instills similar values and norms. As a result, particular professions can entail similar normative expectations of what is legitimate or 'proper' professional behavior (Greenwood et al., 2008). In accordance with this literature, the findings show that the normative expectations of legitimate professional behavior substantially changed, due to full integration of a new practice.

The findings show an institutional change (i.e., adoption of CRM) with a largely regulative nature. As long as the majority of airlines shows ceremonial adoption and thus do not think it is the right thing to do, CRM has not yet reached full institutional change (Tolbert & Zucker, 1996; Greenwood et al., 2002; Kostova & Roth, 2002). According to literature on institutional change, new practices are fully institutionalized when they are performed in a taken-for-granted manner (without conscious thought) and become the "natural and appropriate arrangement" (Greenwood et al., 2002, p. 61). As most airlines seem to adopt CRM because of regulative (coercive) mechanisms, and only some because of normative mechanisms, CRM has not been fully institutionalized. Only if CRM becomes the *universally* accepted way of organizational conduct, it would be fully institutionalized.

5.2 Theorizing change: what and by whom

Even though the findings are in accordance with the general outline of the institutional change process (Greenwood et al., 2002), one particular stage is not supported. Greenwood et al. (2002)

describe the fourth stage of this process as the stage in which theorization occurs, which serves as an important precursor of further diffusion of a new practice in an organizational field. As such, they describe theorization as a process that solely occurs in one particular stage during institutional change. The research findings illustrate the contrary, as theorization seems to be a process that occurs throughout the entire institutional change process. This is in accordance with Munir (2005), who argues that theorization begins as soon as an actor deliberately draws attention to a particular event in order to legitimize change. This conception is in accordance with the core premise of the current research, namely that no single event is inherently disruptive (Hughes, 1983; Bijker et al., 1987; Bijker & Law, 1992). Instead, it is theorization to which "they owe their significance, scope and relevance" (Munir, 2005, p. 94). As such, the first stage of the model of Greenwood et al. (2002) can entail a disruptive event, but it is only the theorization that makes this event disruptive to particular institutions. This subsection will discuss the theorization process in more detail by answering the second sub-question: which theorization efforts, and by whom, were made to provoke change in the field of commercial aviation?

Theorization has been defined in the literature as a strategic method for deliberately influencing the process of social construction by framing ideas and practices into compelling formats in order to legitimate change (Greenwood et al., 2008). According to Tolbert and Zucker (1996), this process entails two "tasks": specification and justification. With specification, actors specify the general organizational failing (in the field), which challenges the adequacy of existing ideas and practices. Such specifications can be done, for example, by framing particular events (i.e., trying to theorize them as disruptive). When the adequacy of existing ideas and practices becomes unstable, the justification task is to name new organizational arrangements (i.e., ideas and practices) as the right solution. Taken together, theorization consists of defining the problem (as a need for change) and providing the solution for that problem (as the desired change).

The findings show that theorization occurred during the entire development of CRM in the field of commercial aviation. The first act of theorization came from accident investigators, by starting to systematically shed light on human factors as a frequent cause of aviation accidents. This development was mainly the result of accident investigations of the Tenerife Air Disaster, and later of the accident in Portland. According to Munir (2005), theorization begins as soon as a particular actor deliberately draws attention to an event (in order to legitimate change). Hence, accident investigators theorized change by deliberately shedding light on the human factors-related

causes of, among others, the respective accidents in Tenerife and Portland. In doing so, they specified the general organizational failing: human error, as the main cause of aviation accidents (Tolbert & Zucker, 1996). This created a reflection on the technical nature of pilot training. This is in accordance with the literature, because theorization efforts are said to create a reflection on the status quo in the field (Greenwood et al., 2008). Although the research findings suggest that accident investigators, as a type of federal agency, play an important role as a theorizing agent in the process of institutional change, these organizations have not yet been identified in the existing literature on theorization (Greenwood et al., 2002; Rao et al., 2003; Munir & Phillips, 2005).

Besides the theorization by accident investigators, which was mostly based on specification, the main part of the findings – the first three phases – can be characterized by theorization efforts that are in accordance with both theorization tasks described by Tolbert and Zucker (1996). In the first stage, as some taken-for-granted beliefs about pilot training became unsettled due to the accident investigators' specification, some specifications were done by mentioning the number of accidents that happened because of human error. Subsequently, the justification task was done by advocating for more attention for educating and training pilots in human factors. This theorization was especially used by federal agencies to theorize more attention for human factors. While these theorization efforts were relatively similar in their content, they were not yet specific. In short, not all actors specified the general failing in the field, but they all used the same justification – despite of its abstraction. This is in accordance with Munir (2005), in the sense that theorization also takes place in the very first stages described by Greenwood et al. (2002).

The abstraction of justifications decreased in the second phase identified in the findings, as CRM-training for pilots was introduced as a new practice that should tackle human error. This new training was formally addressed during an international conference in 1979, held by NASA. During this conference, they first mentioned the general organizational failing in the field, which was the ineffective coordination of resources and a lack of teamwork in the cockpit as the cause of many aviation accidents. Second, they mentioned the solution to these problems in their justification, which was CRM-training. Hence, the international conference was a clear act of theorization by NASA, as it is in accordance with the theorization tasks described by Tolbert & Zucker (1996). Furthermore, this particular event had considerable effects on further theorization efforts, as NASA 'took the stage' to theorize change in a very concrete manner. Recent literature on institutional theory has focused on this kind of events, which are called Field Configuring Events (FCEs). FCEs

are defined as temporary organizational settings, such as professional gatherings, business ceremonies and conferences, "in which people from diverse organizations and with diverse purposes assemble periodically, (…), to announce new products, develop industry standards, construct social networks, recognize accomplishments, share and interpret information, and transact business" (Lampel & Meyer, 2008, p. 1026). FCEs can reshape or even undermine existing practices (or 'technologies') in organizational fields and so organizers of such events often have the goal of influencing the evolution of an organizational field. In accordance with this theory, NASA seems to have organized the international conference in 1979 to publically announce CRM-training as a new practice in order to influence the evolution in the field of commercial aviation. And so, again, the findings show an important role for federal agencies in the theorization process.

The findings show that, likely as a result of NASA's international conference, other actors in the field of commercial aviation started to theorize the adoption of CRM. Instead of specifically naming what went wrong in the human factors-related accidents, they specifically mentioned the Tenerife Air Disaster, as they framed it as a textbook case of how ineffective coordination of resources and a lack of teamwork could go wrong. Also, many actors mentioned the percentage of accidents that had human factors as the cause. Subsequently, the justification would be mentioning CRM, which was similar to NASA's justification.

After this phase, the findings show that several actors continued to theorize further adoption of CRM. They did so by the mentioning that many cockpits did not work well together and subsequently showed beneficial outcomes of CRM-training for people inside the cockpit. So, instead of just mentioning CRM-training in the justification task, some actors started to show the field the benefits of CRM. Besides theorization for widespread adoption of CRM by trying to persuade airlines in the field that did not do so yet, other actors (e.g., accident investigators) started to theorize regulating CRM in order to enforce further CRM-adoption. This type of theorization started with the specification of the general failing in the field, which was the fact that a lot of airlines did not adopt CRM on a voluntary basis. Subsequently, the justification of the solution would be regulations to force these airlines to adopt it. According to Munir (2005), theorization occurs throughout the entire institutional change process and is aimed at legitimizing change. As such, theorizing CRM regulations can be seen an act of theorization too, as it is primarily aimed at regulators to enforce airlines to adopt CRM. These findings do not correspond with the model of Greenwood et al. (2002), as they assign theorization to a particular stage that occurs prequel to

diffusion of the practice in the field. As such, they indirectly argue that there is no theorization between diffusion and full institutionalization.

Taken together, these findings suggest that theorization occurs throughout the entire institutional change process, which is in accordance with the conception of theorization by Munir (2005). Unlike Munir (2005), the current research focused on theorization efforts in light of the two tasks of theorization described by Tolbert and Zucker (1996). In doing so, the research findings show that theorization efforts have cyclical nature, as the specification and justification was continuously adjusted during the evolution of the new practice. In other words, the research findings show that actors adjust their theorization efforts in an ongoing and cyclical nature in their attempts to legitimize change. Moreover, as the research findings show that theorization even occurs during the diffusion stage identified by Greenwood et al. (2002), the research findings expand the scope of theorization. This adds to the study of Munir (2005), because his study solely focuses on theorization in the early stages of institutional change. As such, theorization begins as soon as an event is brought to our notice, as Munir (2005) argues, but also takes place during diffusion in the institutional change process.

5.3 Limitations

The limitations of the current research can be divided into methodological limitations and limitations of the researcher. The following methodological limitations have been identified. First, because a single case study was conducted, the research is limited in its generalizability (Eisenhardt, 1989). As mentioned previously, the qualitative version of generalizability is transferability, which is concerned with "the extent to which the findings of one study can be applied to other situations" (Merriam, 1989, p. 39). The current research aimed to ensure this by providing a thick description of the context or setting of the research. Also, after this limitation section, the boundary conditions will discuss the extent to which these findings might be applicable to other situations. Other limitations of case study research are the difficulty to replicate it because of its unstructured research process, and the lack of transparency with regard to the processes of data collection and analysis (Bryman, 2012). By providing a detailed description of these processes, I tried to minimize these limitations.

Second, there are limitations with regard to the sample of interviewees. Despite the fact that the last interviews showed a point of data saturation, the sample size was small, because only eight interviews were conducted (Bryman, 2012). Also, the current research used different types of data

for exploring the development of CRM in Europe and in the U.S. For the European developments, mostly primary data (i.e., interviews) was used. On the contrary, for the U.S. developments, mostly secondary data (i.e., documents) was used. This difference in data use could have negatively affected the credibility of the research findings, because in this way, triangulation is not fully applied. Furthermore, the actual sample of experts on CRM was restricted to professionals from The Netherlands, while they were used to collect data on the entire field of commercial aviation, which spans Western Europe and the U.S. As such, the sample of interviewees is restricted in its representativeness. The same holds for the sample of documents. Finally, only half of the interviewees responded to the respondent validation. This could have negatively affected the credibility of this study, because not all interpretations of the selected quotes could be checked.

Besides these methodological limitations, there were also limitations of myself as a researcher. First, as I was the only interviewer and coder in the research process, the process of data collection and analysis could have been biased by my own expectations or assumptions. This could have negatively affected the confirmability of this study. Second, during the interviews, I had to learn the skill of conducting semi-structured interviews. As can be seen in the first interviews in the appendixes, I often slightly answered the questions myself in attempting to explain the initial question. Once I noticed this behavior, I deliberately tried to control this. Still, because of this behavior, I could have affected the research findings.

5.4 Boundary conditions

The findings of this study could be applied to other situations, which are related to the characteristics of the case of this study. Commercial aviation can be characterized as a high-risk and technologically intensive industry (Hudson, 2003). Accidents in such industries can have great consequences for society. As such, these findings may be generalized or applied to similar industries with similar processes and safety approaches. Examples of such industries are the oil and gas industry, and health case (Hudson, 2003). Accidents in these industries can lead to (a large number of) casualties, and, therefore, both industries have safety procedures that are similar to the ones in commercial aviation. The findings of the current research could be applied to these industries, because it can provide organizations within such industries with an insight into what happens after a catastrophe, and strategic actions that can be taken to replace particular practices.

6. Conclusion

The aim of the current research was to fill up the gap in the literature with regard to how particular events are framed as disruptive during the theorization process, and how actors theorized change in light of this disruptive event. This has led to the following research question: *how did actors within the organizational field of commercial aviation theorize change regarding aviation safety in light of the Tenerife Air Disaster?* The current research showed that, during institutional change, theorization is an ongoing process with a cyclical character. More specific, specifications as well as justifications were continuously adjusted during institutional change. This started with the specification of the exact cause of the disruptive event. When this interpretation became clear and the solution became concrete, the specifications and justifications were adjusted and (thus) other discursive strategies were used. One particular theorization effort was aimed at specifically framing the Tenerife Air Disaster as a textbook case of the worst thing that could happen because of human error. As such, among other theorizing efforts, the Tenerife Air Disaster was used to specify the general organizational failing in the specification task of theorizations. Considering this, the current research suggests that theorization occurs throughout the entire process of institutional change. This is in accordance with the small body of research (Munir, 2005; Munir & Phillips, 2005) that argues against the dominant notion of theorization as a process that solely takes place in one stage of the institutional change process (Greenwood et al., 2002). Despite this objection to one particular stage in the institutional process, the current research supports the other stages of institutional change defined by Greenwood et al. (2002).

6.1 Contributions

Taken together, the findings contribute to the literature in several ways. First, in the broad sense, it provides insight into the process of institutional change by showing how a new practice became (partly) institutionalized. Second, it adds to the small body of research on theorization as a process that occurs during the entire institutional change process (Hoffman, 1999; Munir, 2005; Munir & Phillips, 2005), by showing that theorization also takes place shortly after a disruptive event and, more importantly, between diffusion and full institutionalization. The latter did not receive much attention by Munir (2005), and so it adds to conceptualizing theorization as spanning the entire institutional change process. Third, the current research adds to the literature on theorization by showing that it has a cyclical nature. By focusing on the tasks of theorization (Tolbert & Zucker,

1996), it was shown that these tasks were continuously adjusted. Fourth, the current research adds to the literature by focusing on theorization efforts in light of a catastrophe (i.e., the Tenerife Air Disaster), as a particular type of disruptive event that did not receive attention in the literature yet. Finally, it suggests a new type of theorizing agents that have not yet been identified in the literature: federal agencies. And, more specifically, accident investigators. These agencies played an important role in theorizing change in light of the Tenerife Air Disaster.

6.2 Practical implications

Besides the theoretical implications of the current research, there are several practical implications too. First, the current research provides organizations with a clear insight into how other organizations in their (organizational) environment can be persuaded to adopt new practices after a particular event. More specifically, it shows how language can be strategically used in this persuasion. By using one or more events in this persuasion, the need for adopting the new practice can be illustrated. As such, organizations that aim to push through a new practice in their organizational environment after a particular event, can use these strategies to do so.

Second, the current research shows these processes of persuasion after a catastrophe, which is a particular type of event. Catastrophes are not likely to occur in all industries. Rather, this type of event is more likely to occur in high-risk industries, such as the oil and gas industry and health care. As a consequence, these organizations have similar safety concerns. Still, established safety practices do not always change spontaneously. Rather, sometimes something needs to happen to instill some reflexivity, such as a catastrophe. The current research shows organizations in such industries that these events can be the start of change, but they have to be actively framed in order to make that change happen. In other words, other organizations have to be persuaded to adopt a new safety practice after a catastrophe. The current research provides organizations in such high-risk industries with a toolbox of discursive strategies to persuade other organizations to adopt a new safety practice after the occurrence of a catastrophe.

6.3 Further research

The current research provides useful starting points for directions in further research. First, more research should be devoted to examining theorization as a process that spans the entire process of institutional change. Second, despite the fact that the current research found several types of theorization, it is unclear what their respective effects were on the institutional change process.

Future research should focus on trying to determine which types of theorization are effective, and which ones are not. Third, the current research identified an FCE as an important development in the theorization process. Not only was this FCE identified as an actual act of theorization, it also shaped the following theorization efforts. Further research should examine if FCEs can indeed be understood as a specific type of theorization in the institutional change process. Fourth, the current research identified an important type of theorizing agents: federal agencies – and, especially accident investigators. Future research should study cases with federal agencies in the field to examine if these actors are indeed important theorizing agents. Finally, future research could focus on a new channel of communication that could play an important role in the theorization process: social media. The current research only focus on the traditional media, but social media could be a neglected channel of communication in research theorization in the institutional change process.

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Appendix 1. Contact letter

This contact letter is the translated version of the original, which is in Dutch.

Dear Mr. /Mrs. /Ms. (…),

My name is Daniël Dekker. I am 23 years old and I am studying for a Master's Degree in Business Administration at the Radboud University in Nijmegen. The reason for reaching out to you is the research I am doing for my Master's Thesis.

This research takes place within the framework of international aviation, wherein around 1980 the idea originated that 'human factors' or 'non-technical skills' should be trained to airplane crews to prevent accidents. From there, Crew Resource Management emerged, which nowadays is one of the standard training forms within international aviation. In my research, I am specifically interested in the period from the first introduction of CRM until the final, widespread adoption of CRM as a training in international aviation. In studying this period, you can think of, for example, the following questions:

- How did the diffusion of CRM, as an accepted part of pilot training, develop? Where did this diffusion start (U.S., Europe)? Where there particular parties that strongly promoted CRM (or condemned it)?
- Was there resistance from within the industry against this training form (training in non-technical skills / human factors)? If so, which parties resisted it and what was the exact content of this resistance?
- Did accidents, like the air crash in Tenerife in 1977, play a specific role in the development of CRM?

In order to comprehensively map this development, I am conducting a document analysis and expert interviews. For the latter, I could very well use your input. Given that you are an expert in (…), I would hereby like to ask you if I could do an interview with you. This could take place on a particular location, but also via telephone or Skype.

The findings of my research might provide you with an interesting insight into the process of adoption of a new (training) practice in the international aviation industry.

I would like to hear from you if you are willing to participate in my graduation research.

Thank you in advance for your response.

Respectfully yours,

Daniël Dekker

E-mail: daniel.dekker@student.ru.nl

Tel.: +31 (0)6 292 437 83

Appendix 2. Interview guide

This interview guide is the translated version of the original, which is in Dutch.

This interview guide is meant to approach every interview in my research in a relatively similar manner. There is space to elaborate on the answers of the participants during the interviews. It is, however, of importance that every participant answers the questions stated below, for as far that is possible. Everything that is in italics, are instructions for me as an interviewer. This will not be spoken out in the interviews. Everything that has a grey background is an explanation to the foregoing.

Guideline

First, I would like to thank you for making time for the purpose of participating in my research. Your participation in this interview is completely anonymous. Do you mind if I make a sound recording of this interview? You can stop the interview at any moment if you feel the need to do so. The interview will take 45 to 60 minutes, do you agree with that?

Before we start, I will give a short summary of my thesis research. This research takes place within the framework of international aviation. Nowadays, Crew Resource Management, which I will refer to as CRM from now on, is a widely supported training form in the aviation industry. However, it takes a long-lasting process before such a training becomes widely accepted. In my research, I am specifically interested in the period from the first introduction of CRM until the final, widespread adoption of CRM as a training in international aviation. In order to comprehensively map this development, I conduct a document analysis and expert interviews. These interviews do not only serve as a validation of the findings from the document analysis, but also to deepen these findings. Especially the details and nuances make the evolution of CRM interesting.

Do you already have any questions at this moment?
If so, provide space for it. If not, start with the interview.

We can begin with the interview. If you have any questions during the interview, feel free to ask them.

Interview guide:

1. Could you tell something about yourself and your position?
    a. For how long have you been working in this position?
    b. *Highlight the participant's career in aviation.*

2. What do you understand by CRM?

    Explanation: verify if this corresponds with the definitions of CRM from the document analysis.

    a. *If applicable, ask if there is a difference in understanding of CRM between pilots and instructors/trainers.*

3. What do you think of CRM?
    a. Do you share this opinion with your colleagues and/or other parties within aviation?

4. What do you think has been the reason for training CRM? In other words: what has ensured that people started to train in this type of skills?

    Explanation: at this moment, I deliberately do not mention the air crashes that occurred around 1980, in order to see if the participants mention them by themselves.

    a. My previous research indicates that the discussion on Human Factors had been going on for some years. How did CRM emerge from there?
    b. What was the relation between CRM and Human Factors at that time?
    c. When did the focus on Human Factors emerge?
        I. Where did this emerge?
        II. How did this emerge?
    d. *If no word about air crashes:* did the crash in Tenerife in 1977 play a role in the reason for introducing CRM?

5. What did CRM look like in the beginning, at the moment it just started?
    a. It was called *Cockpit* Resource Management back then. Was this different from *Crew* Resource Management? If so, in what way?
    b. Was there a difference between definitions of European and American parties?

6. How was the introduction of CRM received in international aviation?
    a. With airlines, unions, pilots, etc.

b. Where there particular parties strongly in favor of training CRM?
    I. If so, was there a difference between Europe and the U.S.?
c. Was there resistance against this new type of training?
    I. If so, where did this resistance come from? *Think of airlines, individuals, unions, etc.*
    II. What was the exact content of this resistance?

7. Is CRM, at this moment, a widely accepted training form in the entire aviation industry?
    a. If so, when did you had the idea that CRM became widely accepted?
        I. If this was a specific moment, why that moment?
        II. My previous research indicates that a couple of regulations have been made by, among others, the FAA and the ICAO in the 1990s. Did this play a role in the perception of CRM? If so, what exactly was this role?
    b. If not, why not?
        I. Do regulations play a role in this?

8. Do you maybe have any suggestions regarding documents I should study in order to further deepen the evolution of CRM?

9. These were my questions regarding the interview. Is there something you would like to say about, or add to what we just discussed?

This is the end of the interview. I would like to thank you very much for your participation. What did you think of the interview? Do you have any questions?

Are you interested in the findings of this research? I could send you my thesis or a short overview of my findings. Besides, I would like to send you the transcript of the interview, in order to ask you if you agree with everything that is stated on paper.

If you have any questions regarding the research later on, you can contact me on the following e-mail address: daniel.dekker@student.ru.nl

Appendix 3. Codebook

Selective codes	Axial codes	Open codes	Definition	Sample quote
Theorizing change			All efforts to legitimize change through specification and justification.	
	Specifying the need		All efforts to point out the need for change by specifying the general failing in the field.	
		Consequences of bad resource management	The specification of the general failing in the field by mentioning what can happen if pilots are not trained in CRM.	*"One of the new concepts they [aviation psychologists] have introduced is an approach called cockpit resource management, which teaches pilots to work together so that an unexpected cascade of small problems on a flight doesn't escalate into a catastrophe."*
		Human factors accident rates	The specification of the general failing in the field by mentioning the amount or percentage of human factors-related accidents in (commercial) aviation.	*"For at least the last 15 years, more than 60% of all commercial fatal accidents have had, as one cause, poor management of the resources available to the cockpit. Recognizing this, Cockpit Resource Management training (CRM) is today the focus of many aviation interests."*

Selective codes	Axial codes	Open codes	Definition	Sample quote
		Major aviation accidents	The specification of the general failing in the field by specifically mentioning major aviation accidents like the Tenerife Air Disaster and the United Airlines crash in Portland.	*"(…) the United DC-8 fuel exhaustion accident in Portland, Oregon, and the worst airline crash in history – the runway collision between two jumbo jets at Tenerife, Canary Islands – each had human factors as a primary ingredient. Listening to the cockpit voice recordings leaves me cold and dry-mouthed."*
		Only small-scale adoption	The specification of the general failure in the field by mentioning that still only a small amount of airlines had adopted CRM.	*"Although CRM training can be viewed as a proactive means for an organization to ensure the safety of its flight operation, some organizations wait until they have experienced an aircraft accident before they initiate a CRM training program."*
	Providing the solution		All efforts to justify and promote the solution for the specification of the general failure in the field.	
		Insights from training	Promoting the solution, CRM, by providing beneficial insights from CRM-training.	*One corporate pilot said of his CRM training, "one thing that I see is that I have not given up my authority, and in fact, it has enhanced my authority. The trip goes a lot better because they [other crew members] feel more comfortable*

Selective codes	Axial codes	Open codes	Definition	Sample quote
				bringing forth input, and they don't have to do it in an aggressive, ticked-off manner".
		Shifting focus	Promoting the solution as a shift in focus from training pilots in their technical skills to training pilots in their 'softer', non-technical.	*"We've spent 30 to 40 years teaching people how to use systems, but we've never gotten into the part that's just as important, the people who fly the planes".*
		Regulating CRM	Promoting the solution as regulating CRM to compel every airline to adopt it.	*"The Federal Aviation Administration (FAA) has known for more than a decade of pilot training techniques to encourage pilots to act as a team to guard against blunders by an individual. But the agency has taken only tentative steps toward requiring airlines to teach it to their pilots."*
		Guidance material for easy and cheap adoption	Promoting the solution, CRM, through guidance material that enables easy and cheap adoption.	*"The CAA does that, for example, in the field of CRM. CAP, I think that is the abbreviation for Civil Aviation Publication, 737. (...). For years, that has been the document, of at least 120 pages, that tells you what CRM-training is, how you can teach it (...)."*

Selective codes	Axial codes	Open codes	Definition	Sample quote
		Window dressing	Promoting the solution, CRM, through specifically showing the field that you incorporated it.	*"United's program stresses that two or three heads working on a problem are likely to arrive at a better answer than one head resisting or not hearing suggestions from others. We can't change personalities, but we can change the ways crew members operate with each other (…)."*
Resistance to change			All resistance to the general evolution and/or adoption of CRM.	
	Type of resistance		All types of resistance to the general evolution and/or adoption of CRM.	
		No voluntary adoption	Only a small amount of airlines adopted CRM on a voluntary basis. The large part did not.	*"The training is expensive; it requires the use of multimillion-dollar flight simulators and complex computer programing to simulate flying conditions for crews, who perform the exercises together. Not all airlines have such a program."*
		Quick fix adoption	When CRM became regulated, many airlines adopted it, but did not integrate it into their organization.	*"I think that, when you look at CRM, it was already legally required, but it really was a separate part: 'oh, right, we also need to do something with CRM' [like they forgot]."*

Selective codes	Axial codes	Open codes	Definition	Sample quote
		Not assessing CRM	Even if CRM was adopted as a training, many airlines did not assess their pilots, even though it was much needed in the industry.	*"Well, with companies like British Airways, it is not even done. There, you are solely assessed on your technical skills. That is still the case."*
		Against abstractness of human factors	Many pilots resisted the abstractness of human factors as something that is psycho-babble that was not concrete.	*"The initial suspicion among pilots was that it was some kind of charm school; that you had it in a hot tub holding hands, (…)"*
		Against softness of human factors	Many pilots resisted the softness of human factors as something that was not manly.	*"You'll never get ol' John to do all that airy-fairy crap. He's a crusty old guy and he'll die with his boots on".*
		Taking it as personal critique	Many pilots took the increasing attention to human factors as personal critique on their flying abilities.	*"Guys are not, contrary to what FAA would have you believe, flying around with their white scarves hanging out their windows and would not fly under the Golden Gate Bridge if they could. (…). Guys are not deliberately taking airplanes off and risking passengers' lives and their own lives."*
	Source of resistance		All sources that caused the different types of resistance	

Selective codes	Axial codes	Open codes	Definition	Sample quote
			to the general evolution and/or adoption of CRM.	
		Efficiency-quality trade-off	Many airlines made a trade-off between efficiency and quality in deciding whether to adopt, and later on integrate, CRM (into their organization).	*"(…). That is a continuous balance of: going for quality or going for efficiency. That plays a major role everywhere, but especially in aviation."*
		Personality	Most pilots had a very specific personality that did not fit the characteristics of human factors.	*"Pilots are, of course, 'doers' and are focused on solutions. And then this, well, lubricating oil [metaphor for CRM]? For me, that is clear. But someone who does not speak that language could say: lubricating oil, do not bother me with that. You either do it right or you do it wrong."*
Key features of change			All key features that were part of the CRM-evolution in the field of commercial aviation.	
	Cultural change		During the evolution of CRM, the field has undergone substantial cultural change.	

Selective codes	Axial codes	Open codes	Definition	Sample quote
		The meaning of 'pilot'	During the evolution of CRM, the meaning of being a pilot has changed.	*"They're more receptive to input from others, though still in command of their job. The pilot uses all the resources available, instead of choosing to do it alone."* Or: *"Flying, (…), is becoming quite literally a management job."*
		Industrial culture	During the evolution of CRM, the industry culture changed from a closed, blame-culture to an open, just-culture.	*We do not want to have a blame-culture. We want to have a just-culture. We assume that, when you get out of your bed in the morning, you like doing your job, you are not there to ruin the days of your colleagues, nor to deliberately cause a crash. (…). When you make a mistake, it is not you, so to speak, but rather the context you were in that caused it. (…). And that is an important one, because that just-culture actually continued to grow parallel [to CRM] in the industry."*
		Integrating CRM	Because of the integration of CRM into the entire organization, some airlines made it a way of thinking and working.	*"More and more, we try to show people that CRM is not a separate thing, but rather a fully integrated into everything we do. Even in technically flying an airplane."*
	Key factors of change		All key factors that influenced the evolution of	

Selective codes	Axial codes	Open codes	Definition	Sample quote
			CRM in the field of commercial aviation.	
		Training didactics	Along with the evolution of CRM, trainers found a way to translate the abstract language of human factors and/or CRM into practical language that was understood by pilots.	*"You know, great theory, but what can I do with it in practice? (…). As a trainer, if you do the same type of work, you can contribute to the training by providing examples from practice (…). That translation, to develop people in this field, can, on a deeper level, only be done by people that work in the same field."*
		Regulating CRM	Regulations by the regulators in Europe and the U.S. eventually forced every airline to adopt CRM.	*"(…) And that is the importance of regulations. That the regulations indicate: guys, we can haggle about it, but this is the minimum level we demand. And that is what you need the legislator for. When you do not have the legislator, people will absolutely remove it from their program, because at the end of the day it is about the profit and loss statement."*
		Commercial interests	Commercial interests forced airlines that were directly involved in major accidents to adopt CRM.	*"We had Tenerife and they had that bulb [the United Airlines crash] so to say. That has been the motive for them. If you slam into the ground in front of the crowd, well, that makes a difference. (…). Then you have to say: we have got the solution: CRM-courses! The commercial interests are just very large."*

Selective codes	Axial codes	Open codes	Definition	Sample quote
		Human factors accident investigation	The start of focusing on human factors in accident investigation made it possible to gain insight into the frequent cause of aviation accidents: human error.	*"The National Transportation Safety Board is also well on the road in establishing a broad aircraft-accident database to shed light on human factors essentially ignored in the present data system. A lack of human factors accident data, in fact, has precluded meaningful response to certain repetitive problems."*
		Recruitment	The recruitment of pilots with personalities that suited the characteristics of CRM facilitated the cultural change that could foster CRM-adoption.	*"Back then, we said: you just have to be able to fly. If one can fly properly, we hire him. Now we say: well, we assume he can fly, but we want to see if he fits in our company. That is a completely different perspective. (…). We now primarily only look at personality."*

Appendix 4. Interview transcripts

The following appendixes were all added to the e-mail that was sent to the supervisor and the second examiner:

Appendix 4.1 KLM captain
Appendix 4.2 KLM captain
Appendix 4.3 KLM captain
Appendix 4.4 Transavia captain
Appendix 4.5 Independent trainer
Appendix 4.6 Independent trainer
Appendix 4.7 NLR training specialist
Appendix 4.8 Independent aviation expert