CRITICAL INCIDENT REPORTING SYSTEMS:

A NECESSARY MULTILEVEL UNDERSTANDING

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Highlights

• Meaning in a complex socio-technical system is created through social interaction.
• A reporting system holds a safety value skewed by an inflated focus on statistics.
• Sharing critical incident and investigation reports does not equal learning.
• A decentralized safety power distance allows for a safety focus to be re-calibrated.
• Human relations across organizational levels directly influence quality of reporting.

Abstract

The nature of critical incident reporting systems and the reality of underreporting of critical incidents in complex socio-technical environments may have skewed our view of causality when it comes to safety management. This study explores the social construction of reporting through case based thematic analysis across three organizational levels and four stakeholder groups in an African Air Navigation Service Provider. The study shows that the reporting system and the act of reporting are not the only drivers. Reporting emerges as a mere actor, while new dimensions of safety drivers emerge from the study: safety also comes from a value contribution focus, a decentralized safety management approach, the centrality of reporting in a safety management system and the dependency on engaged relationships. The study concludes with an illustration of how these dimensions interact and inter-relate, and the necessity of such cognizance in system design and reviews.

Key words: Critical Incident Reporting, Safety Management Systems, Reporting Behavior, Social Construction.

1.   Introduction

1.1   *A need for critical incident reporting*

Professor Liam Donaldson from the World Health Organisation once said that "*to err is human, to cover up is unforgivable, and to fail to learn is inexcusable*" (Patient Safety Technical Briefing to World Health Assembly, n.d.). Moreover, Müller-Leonhardt, Mitchell, Vogt and Schürmann (2014) add that within hospitals and air traffic operations, which operate as complex systems, the occurrence of critical incidents are unavoidable. The latter authors go on to illustrate that even minor incidents are an opportunity to provide valuable feedback for reviewing and improving the safe operation of a complex safety management system (SMS).

Yet Di Gravio, Mancini, Patriarca and Costantino (2015) stated that Air Navigation Service Providers (ANSPs) use basic metrics such as frequency of traffic counts and number of incidents to express their safety performance. These authors argue that these generic indicators fail to represent the overall safety performance of the system as well as the underlying safety perspective of the operational fraternity. In certain cases the significance of such a safety parameter bias creates a simplicity perspective that easily transforms into a systemic weakness (Patil, Geedipally & Lord, 2012). The bottom line is that critical incident reporting remains a critical component to any SMS.

We chose the definition of Staender (2011) as an appropriate definition of a critical incident. A critical incident in this study is considered any and every occurrence that departs from normal routine and that originates from the process at large, the technique applied by the operator or the environment. Most critical incidents though appear to originate from a combination of these domains.[1]

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[1] Staender's (2011:209) extended definition of a critical incident is: "*Every occurrence or non-routine situation can have its origin in the processes, the technique, the environment and the human/team or in any combination of all these factors. A critical incident can either return to normal operations (if primary defences, such as Standard Operating Procedures, are in place and function sufficiently) or develop into a critical one when these primary defences fail. If there are no recoveries available or it is not working for a specific critical incident, an accident will occur. Should a recovery be functioning, the situation will end in a near-miss*".

1.2   Aim of the study

Rochlin (1999) explains the importance of continued and expanding research and enquiry into the reporting and performance of safety beyond just its statistical and measurable properties. The author goes on to explain that safety should be explored from the perspective or experience of safety as a corporate myth and ritual as well as that of agency and structure. The non-academic view of safety is, however, usually limited to a way of expressing the avoidance of consequential accidents. In addition, the mainstream safety research and operational safety focus has been aimed at the reporting procedure and the operating system rather than on the individual-level behavior and cognition that produces safety.

The aim of the study therefore, is to explore and understand the social construction of reporting. In other words, the act of reporting and the subsequent responses to reporting is embedded in organizational practices, conventions and conceptual schemes of groups and individuals. These phenomena are bounded by time, context and environment where meaning is constructed through various facets of culture and human decision-making (Mallon, 2007). We see this gap in the literature as a call for a multi-level view of critical incident reporting, from a social construction theory point of view. We expect that obtaining narratives from safety stakeholders that differ significantly in role and authority will broaden our understanding of reporting behaviour and the fluidity it introduces to safety systems. This study is particularly concerned with individual behavioural differences across organizational levels that may influence organizational reporting and subsequently safety management practices such as investigations.

Therefore this paper sets out to test the following two questions worthy of investigation. Is there a social context within which reporting occurs and which is influenced by a collective, inter-subjective and connectionist dimension of operation? The authors set out to understand what this social context looks like from the perspective of the multitude of factors that influence the decision making process of safety stakeholders when they digest a potential critical incident prior, during and after the act of reporting. The second research question has to do with the assessment of a reporting system by adding the dimensions of social context, safety system history and local information, which are constructed at varying organizational levels.

The authors believe that the nature of the research questions lends itself to an interpretive case-based methodology with an associated thematic analysis to delve into the depths of the social construction of reporting and underreporting. As meaning is created in different spheres within an organisation through the social construction of reporting related behaviour (Gergen, 2009), the application of a case study approach with a thematic analysis enables a deep dive into the detail under the surface that informs the social construction of reporting.

1.3   Potential contributions of the study

The study contributes to system safety on a practical and theoretical level. The first contribution being by a depiction of how social behaviour influences and is influenced by a safety system and other organizational and industry activities. In other words, having a good safety philosophy and reporting procedure is not enough in a complex safety critical industry. Therefore, improving safety requires ANSPs to also understand how these policies and procedures impact operator and line manager behaviour versus how senior management behaviour influence the application of procedures.

On a theoretical level the study show cases the interesting multi-dimensional reality to system safety that emanates from the social context across organizational levels. These contexts illustrate a broader spectrum of safety behaviour that would otherwise be restricted to the study of the physical system, the report and the act of reporting. The literature illustrating these realities and the aforementioned organizational and social gaps are discussed next.

1.4   A literature review of the antecedents to critical incident reporting

We begin by providing a reflection on the focus areas of research specifically pertaining to a broad spectrum of critical incident reporting related literature that was completed between 1990 and 2016.

Five categories of research focus is found within the literature. These are: i) a systems approach to reporting; ii) statistical underreporting models; iii) enablers of and barriers to reporting; iv) the influence of ethics, morals and culture on reporting; and finally, v) a focus on reporter perceptions and experiences. We found that research to date on the reporting of critical incidents has mainly been found to originate from the medical domain, with some focus on shipping, road accident and aviation reporting systems.

On the first category of a system approach to reporting, Benn et al. (2009) discovered that learning did not automatically occur as a result of the safety or error reports that are submitted to reporting systems, disseminated and distributed again. In the UK health services, this lack of learning was attributed to the absence of a clear procedure for monitoring the lessons that are learned or acted on at local levels. Furthermore, the realisation of participation bias was evident in a Scottish intensive-care unit study where 90% of all reports were submitted by nurses and then the analysis was simplified to an assumption that senior staff were reluctant to participate in reporting schemes (Johnson, 2003). In the same light, Tourtier, Auroy and Grasser (2012) argue that many studies drew conclusions that were too simplistic. For example, from 398 adverse drug events at nine medical and surgical units over an eight-month period, only 23 were voluntarily reported. The simple conclusion was that the disparity stemmed from a

reluctance to make voluntary reports because the social context within which these reports were withheld was not understood.

Secondly, the category of models and predictability in the literature is mainly dictated by studies focussing on underreporting and more so the ability of systems and organizations to predict future incidents from a financial budgeting point of view. Yamamoto, Hashiji and Shankar (2008) are critical about the application of models to determine accident causation and injury severity when such models are not capable of adjusting for underreporting. They found that underreporting is especially prominent for lower injury severities and, as a result, road traffic-accident data can be regarded as outcome-based samples that are over-represented in higher-severity accidents that render the system or industry wide view skewed or biased. This is of course a point in case for the need to understand the social context within which reporting exists.

The third category of enablers and barriers to reporting contain elements of social construction in the findings. For example, Wu, Pronovost and Morlock (2002) had focus-group participants raising the following contributory factors to underreporting as: i) risk of liability, ii) lack of feedback and iii) the burden of reporting. Furthermore, according to these authors, data from critical incident reporting appears to underestimate the realistic level of operator errors because of: i) fears from reporters of unintended consequences; ii) competing safety versus efficiency demands; and iii) the belief and/or judgement that a particular case does not qualify as a reportable incident. In short, contextual factors have a prominent role to play in reporting behaviour as well as the absence of reporting. Context plays a notable role in the social construction of reporting and therefore in decision-making around reporting behaviour.

Fourth, no understanding of reporting is complete without the inclusion of the elements of culture and ethics in understanding behaviour. According to Olson (2000), professional ethics play a vital role in promoting reporting behaviour as it forms the basis from which reporting and underreporting practices evolve. Unfortunately, the opposite is also relevant; research has demonstrated that personal gain and seniority changes views of ethical considerations (Blanthorne & Kaplan, 2008). It will be noteworthy to know how seniority and personal gain influences such considerations from a social construction point of view.

Lastly, perceptions and experiences of reporters are the fifth category we uncovered in existing research and this is the one that best aligns with the social construction of reporting. Typical research in this domain includes, for example, a quantitative study of 1 180 nurses at nursing homes in Ontario, Canada. In this study Wagner, Harkness and Gallagher (2012) discovered that 48,4% of nursing errors were regarded as a serious problem, while 49,2% of the same nursing group regarded the reporting system as inadequate. Following on the above mentioned study, Anderson et al. (2002) found the main barriers to reporting to be: i) an operator fear that the media may get hold of the critical incident detail; ii) the

absence of a tradition in their local workplace to raise and discuss incidents; iii) operators wishing not to appear incompetent; iv) fear of being reprimanded; and v) a fear of damaging future employment or career progression opportunities. Understanding how the mentioned seniority, ethics and a professional culture are influenced by these barriers can be explored through a qualitative approach to social construction. Consequently, a finding like that of Anderson et al. (2002) that non-reporters are one and a half time less likely to admit to a serious incident that should be reported, will not be understood without the social context within which the actions and inactions occur.

1.5 *Critical incident underreporting*

Despite research on the previously mentioned aspects of critical incident reporting, underreporting remains a challenge. For example, Tucker et al. (2014) reflect on studies that have found that between 29% and 81% of work-related injuries and illnesses go unreported by employees. Even in the light of injuries qualifying for workers' compensation, a Canadian study by Shannon and Lowe (2002) still indicated a 57% phenomenon of underreporting. In their own study, Tucker et al. (2014) determined an underreporting rate of 27% amongst a sample of 66 571 respondents.

Moreover, the social influence of management pressure could create an inhibiting pressure to underreport where a 'can do' culture impairs the reporting of incidents (Nicholson & Tait, 2002). Staender (2011) also found that professional cultures, for example, played a significant role where doctors had highly unrealistic attitudes about their own vulnerability to error. According to Wagner et al. (2012) nurses' personal experiences and level of education were more likely to influence error disclosure, above other factors such as the institutional culture in which they worked.

The reporting of critical incidents is therefore an essential part of the learning process and the underreporting of incidents is likely to have a negative effect on the probability and severity of future incidents, subsequent organizational learning as well as the performance of the system. Hence, understanding the social context that creates and sustains underreporting or even reporting is paramount for the sustenance of any SMS.

2. Method

The nature of the research problem and the associated propositions stipulated under section 1 suggest an interpretive case-study methodology combined with a thematic analysis are the most appropriate in order to extract the working of the social phenomenon of reporting (Yin, 2011). This approach was successfully used in exploring new directions in the sociology and history of technology

(Bijker, et al., 2012) as well as the social and cultural construction of risk (Johnson & Covello, 2012). This methodology is applied on an ANSP in South Africa. Fundamentally, the social structures and systems of the ANSP as well as positions, roles, and interactions, are explored as reproduced social structures.

2.1 Sample audience

Data was collected from the ANSP because of the role that air traffic control (ATC) plays in the domain of aviation safety. This is particularly of relevance because of the reporting demand that rests with operational staff in reporting personal error as well as pilot error and a spectrum of other incidents. The ANSP was selected because of the access that the first author had to safety related information within the company as well as applicable respondents across organizational levels.

2.2 Data collection procedure

All data was collected by the first author of this paper. The primary data collection was performed between July 2014 and March 2015. This was achieved by means of focus groups as well as interviews with durations that ranged from 50 to 80 minutes. The categories that emerged from the literature review on reporting was applied to construct the set of questions. The first set of these questions was tested across three airports as a pilot study and thereafter critiqued by two subject matter experts (SMEs) in the fields of aviation safety, safety culture and qualitative methodologies. Prior to each focus group and interview, the respondents received a written and verbal explanation of the intent of the semi-structured questionnaire protocol and the aim of the study at large.

2.3 Sample criteria

Participation was voluntary and a convenience sampling method was applied on the five focus groups as well as the line managers. The participation of focus group respondents were mainly dictated by the availability of ATCs scheduled for breaks on the particularly day and time. A total of 29 volunteers participated in the focus groups. Secondly, the seven interviews with investigated controllers had to follow a purposive sampling approach because of their involvement in investigations after they reported a critical incident. This was achieved through personal invitations being extended to potential respondents based upon the data from investigation reports. Thirdly, the seven line manager interviews were also at random but based upon personal invitations. These line managers are seen as the first line recipients of critical incident reports. Lastly, the four interviews with senior management was based upon the corporate knowledge of the researcher and purposive sampling of those senior managers considered to be directly involved in the safety management activities at a corporate level.

The senior managers were located at the head office of the ANSP while the rest of the respondents were located across six of the twenty-one airports where the ANSP provides a service. All interviews were recorded with a voice recorder and subsequently transcribed for the purpose of analysis. Despite South Africa having nine official languages, the aviation language remains English and therefore all questions and responses were recorded in English. Moreover, extensive field notes were kept during every interview and focus group with the specific goal of capturing the body language, facial expressions and meaningful periods of silence following a question or comment. Refer to Table 1 for an indication of the number of respondents per group.

Table 1

Demographical representation of respondents

Respondent type	Race & Gender[2]								Total
	Black		White		Indian		Coloured		
	Female	Male	Female	Male	Female	Male	Female	Male	
Senior Management	-	1 (25%)	-	3 (75%)	-	-	-	-	4
Line Management	-	1 (14.29%)	2 (28.57%)	4 (57.14%)	-	-	-	-	7
Focus Groups	5 (17.24%)	7 (24.14%)	4 (13.79%)	8 (27.59%)	2 (6.89%)	1 (3.45%)	1 (3.45%)	1 (3.45%)	29
Investigated Reporters	1 (14.29%)	2 (28.55%)	1 (14.29%)	1 (14.29%)	-	1 (14.29%)	-	1 (14.29%)	7

2.4   Questionnaire

The semi-structured questionnaire covered various aspects of critical incident reporting, including describing reporting to a new employee. This description provided a good overview of the predominant themes within the ANSP that direct reporting behavior. Moreover, other questions probed the espoused and actual behaviors of peers and managers as well as corporate actions that influence reporting. Other questions explored the perceived and experienced purpose of reporting and subsequent investigations, the role of policies and procedures, as well as cultural aspects influencing reporting behavior. Finally, the presence of underreporting was delved into from a contextual point of view.

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[2] The percentage in brackets below each race and gender number is expressed as a percentage of the total amount of respondents that participated in each data set.

The same questions were posed to the investigated reporters. However, questions posed to line and senior managers were adapted to study involvement and responses towards actual reporting behavior. In addition, questions were posed to discover experiences of enablers and barriers produced by the system together with the positional view of reporting within the greater safety system.

Apart from interviews and focus groups, we also performed a content analysis on the safety management manual, performance contracts, critical incident investigation reports, and statistics on critical incidents, as well as corporate communiques and artefacts as they related to reporting.

2.5   *Data analysis*

All three different levels of interviews as well as the focus group transcripts were coded separately in Atlas.ti. In other words, the library of existing codes originating from line manager interviews were only used in other line manager interviews and coded as close as possible to the intended theme of the respondents. Hycner's (1985) 13 steps were applied and the respondents were afforded an opportunity to review and comment on the codes applied to their respective interviews and focus groups in relation to their intended meaning.

A total of 1455 codes emerged across the four data sets and was subjected to a thematic identification with an associated clustering sequence of meaning according to a process recommended by Attride-Stirling (2001). A dance ensued between the literature, secondary data and primary data in a journey of making sense and clustering meaning into overarching themes within and across data sets. Coding was undertaken by the first author and then critiqued by the two SMEs as well as the second author during formal briefings.

2.6   *Quality and rigor*

Five elements were applied throughout the study to ensure rigor in obtaining and analyzing the data. Credibility of the data was ensured through facilitated focus groups where accurate descriptions of human experiences were obtained through anecdotes from various respondents within the actual focus groups (Krefting, 1991). This approach allowed for differing experiences to be raised and similar experiences to be re-enforced. Furthermore, these anecdotes were compared to responses from other focus groups and interviews to establish credibility to the corporate narrative around each theme. Member checking was facilitated through the sharing of transcribed interviews and focus groups with respondents that included the first level coding (Reilly, 2013). Respondents were required to check for an adequate reflection of their intended meaning or experience. Reflexivity was achieved by the first author frequently reflecting in the presence of the SMEs that critiqued the operational and contextual validity of the coding

and thematic analysis (Yin, 2011). In a similar instance the second author performed the same role from an academic and methodological perspective. Triangulation was achieved by means of including interviews and focus groups in the data collection phase while also hosting such activities across different regions and airports. The primary data was also compared to the secondary data to confirm the relevance of respondent anecdotes, for example the similarity between respondents' experience, interpretation and reaction to a corporate policy or report (Farmer, Robinson & Elliott, 2006). Finally, transferability exists but in a different way within the study with the saturation of codes that the study reached. Although the results of the study have not been tested beyond the boundaries of the ANSP, the internal validity was confirmed as the study migrated from one Air Traffic Service Unit (ATSU) to the next.

3.   Results

The epistemology was made tangible through the rich descriptions of emotions, experiences and body language shared by the respondents. Front line operators, especially showed signs of frustration and at times despair through the shrugging of shoulders, frowns or deep sighs resulting from the competing demands they experience daily. Suddenly, reporting was not just about judging the context anymore, but also evaluating consequences that may result from the action of reporting a critical incident (or not), consequences that in most instances were trumped by self-preservation (van der Westhuizen & Stanz, 2014).

The typical responses quoted were coded within each of the four data sets and then compared across the data sets as illustrated in Table 2. The themes across data sets in comparisons are described in section 3.1 while the corporate themes are covered as interpretation during the discussion section.

Table 2

Comparing Reporting Realities - Clustered Themes within Data Sets

Investigated Reporters	Clustered Themes			Overarching Corporate Themes
	Focus Groups	**Line Managers**	**Senior Managers**	
Optimization		Risk measure characteristics (includes efficiency and safety as both are products of risk)	Multi-faceted measurement of safety (that includes reporting)	**Negotiation between safety & efficiency**
Value contribution		Influence of reporting sub-cultures	Shared social concept of reporting in safety system	**Social coherence on reporting (focus not on changing sub-cultures)**
Social coherence				
Multiple cultures at play				
Fallibility view (human centered)	Corporate & local safety philosophy alignment/positioning human (safety logic)	Social implications of risk measurement tool	Corporate system safety philosophy checked against actions and aligned (system vs human focus)	**System view on human error**
		Recursive process credibility maintenance – original aim safety		
		Prevention focused		
Learning & Information management	Knowledge distribution	Multiple faceted org learning	Inclusive training on reporting across org	**Knowledge management**
	Inhibited information flow			
Incentive (pos & neg)		Celebrate & award all successes		**Recognition**
	Influential system factors (external to reporting & even safety system)	Recognize reporting as an integral component to a safety management system (not means to en end)	System view of reporting & safety required	**Positioning of reporting within system**
		Position reporting in SMS		

Asymmetrical power (withholding reports)	Human inclusivity link	Internalize safety engagement	Shared accountability across org	**Decentralized safety power distance**
		Mutual approach to risk mitigation		
		Apply a decentralized safety management approach (safety governance not corporate structure)		
Multiple realities			Complex domain requires flexibility	**Prominence of context**
Trust		Formulate corporate expectations of industry reporting		**System response predictability (reliability)**
System consistency		System capability honesty		
Co-dependent relation (saving face)	Human inclusivity link (personal benefit)	Individual focused responses (Individual gain then org learning)	Relationship based reporting (Downward engagement & upward impression management)	**Relationship management at multiple levels (self-preservation)**

3.1 Comparing Reporting Realities

3.1.1 Risk Measure Characteristics

We found the essence of reporting to be approached from what appears to be a blended concept of complementing and opposing philosophies and practices. Senior level management, for example, expresses a realization that a safety ratio (the number of ATC induced incidents per 100 000 flight movements) is not an adequate representation of systemic safety. Despite this notion, the ratio in various forms remains the primary corporate means to express ANSP safety performance. There is a healthy hope or belief that operational staff will report critical incidents because it is the noble thing to do – apart from the prominent reality that is referred to as a regulatory requirement to report incidents. Another argument they expressed was that third party reports from pilots or peers will typically counter for underreporting, although these managers were not oblivious to the possibility of underreporting

Not surprising, line managers appear closer than senior level management to the operational dilemma of reporting. The dilemma emerges from negotiating the balance between efficiency and safety that is not expressed in the corporate safety ratio. The plot thickens for line managers as they are confronted by the impact of the safety ratio on operator behavior. The line managers feel overwhelmingly trapped by their inability to influence the safety ratio while at the same time the mere number fails to

express real safety efforts. The consequence is a safety ratio that drives corporate communication while this mere number (as opposed to actual safety management activities) appears to staff to be the only focal point that dictates responses from influential stakeholders.

When it comes to the system operators (investigated reporters and ATC focus groups), the operators themselves are superficially enthused by the monetary impact of having a critical incident. "*The first thing I thought about was how it was going to affect me.*" This caused underreporting in some instances, not because of personal loss or gain, but the measure of safety applied can sway reporting behavior: "*Some people actually, you know, have an incident without anyone noticing and they wouldn't report it because now it would sort of increase the [ANSP's] safety ratio.*"

The investigated reporters though express the same concern of the line managers on the oversimplification of risk orchestrated by the application of a safety ratio. For some, it appears that the financial implication has in fact distorted the corporate focus to be a purely numbers game rather than a system benefit of reporting.

3.1.2   Context/multiple realities

The focus groups paint a picture of competing demands that range from the noble intent to report incidents for the benefit of the system to dealing with emotional impact, saving face or managing personal fears (van der Westhuizen and Stanz, 2014). In many instances the actual context within which an incident occurs, from the perspective of the operator, dictates the decision making or perhaps even the sense making process prior to the act of reporting. When the focus group probes changed the angle away from the individual and towards the company in order to determine what drives corporate reporting, the ontology of knowledge transfer (Snowden, 2002) was applied. The responses from the majority of respondents across organizational levels were that they would simply refer a newcomer to the ANSP's disciplinary code. This referencing stemmed from an industry regulation that made incident reporting compulsory within the industry with associated penalties - a single, but conspicuous stimulus to social construction. The operators refrain from reporting anything that could possibly be marginal or argued not to be an incident because they do not wish to be responsible for a monetary penalty on peers during the annual bonus pay outs. On the other hand, the focus or intent of reporting was also a prominent reflection of the position of reporting within the ANSP. One respondent described this through a consideration of the context of an incident as follows: "*It's a procedural reduction but I mean it's not like ... a safety event [critical incident], it's not, it doesn't really affect safety.*" Critical information goes astray…

Unexpectedly, a similar theme emerged amongst the senior level managers acknowledging the need for flexibility in a complex domain (context) that influences reportability judgments.

3.1.3   Shared social concept of reporting

Corporate reporting was considered to be in a good state when the number of critical incidents and the severity of incidents were low. The dilemma of counting incidents (safety ratio) to determine system safety is further demonstrated through a senior management notion "…*life is about measuring stuff. If you don't measure it nobody's going to pay attention to it*." This same safety ratio is extended to reflect in the performance agreements of all senior-level managers to illustrate accountability but not necessarily influence or control. This appears to be driven by the monetary connotation on a corporate as well as an individual level – a definitive gain or loss reality. In all instances of senior level interviews there is an all-around sentiment that reporting has improved, although the practice remains unmeasured and therefore unknown or without evidence.

For line managers as with reporters, the influence of sub-cultures and the array of local ATSU constructed definitions of a "Just Culture" contributed to a disparity. The variances in the behavioral display of a "Just Culture" by various managers across organizational levels caused a significant differences in the operator experiences of a "Just Culture". In extreme cases, on the opposite side of the error/violation continuum, a "Just Culture" was even replaced by a "blameless" culture.[3]

A final theme is added by investigated reporters who expand the great divide between the corporate focus and the operator focus based upon intent. This brings us back to the noble intent of the reporter to contribute towards system optimization through reporting. On the contrary, these respondents experienced the investigations as mere re-iterations of existing procedures while apparent risks were not given tangibility.

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[3] A Just Culture is defined by the ANSP as reporting error without fear of reprimand while a blameless culture is considered a culture where there are no consequences for any actions. The authors acknowledge though that an attempt to define or determine malicious or deliberate intent when it comes to safety is a complicated topic that is beyond the scope of this paper. Refer to Dekker (2016) for a broader differentiation.

3.1.4   Safety philosophy

The corporate philosophy depicted by the senior level managers indicates that systemic failures are expected while underreporting or rather human behavior is guided by the corporate disciplinary code. Therefore, corporate risk is defined by the ATC involvement in critical incidents. Moreover, they acknowledge that reporter concerns or even fears is understood and managed at regular intervals to curb potential underreporting intentions. On the side of line managers the safety philosophy was centered on the social implications of the risk measurement tool, e.g. the safety ratio as the only figure that attracts or dictates corporate responses.

The safety philosophy theme was most prominent amongst the focus groups' responses but it was also the most fragmented with many sub-themes. The sub-themes included:

- An intense corporate focus on the ratio that gives rise to feelings that the actual target of safety is missed;
- Corporate expectation communicated/interpreted as safety being associated with no incidents;
- An overemphasis on human fallibility as the single biggest system risk;

On the positive side the focus groups also raised comforting themes on the wider reality that operators still see reporting as an inherent part of the job – no incentive required.

Investigated reporters however highlighted a single, but prominent, theme on safety philosophy that is shaped by the negative association surrounding the corporate view on human fallibility. As reality is known through a co-dependent relation (Karatas-Ozkan & Murphy, 2010), the relationship between managers and operators were captured through responses such as "*… because now you feel like your boss is already standing against you and they haven't even started the investigation yet"; or "… it looks like they're out to get you, you know.*" In this social context reporting is only associated with failure as a professional.

3.1.5   Knowledge management

Senior management tasked with safety also faces challenges around the lack of understanding from a wider support function. The descriptions are circling around self-helplessness where it is acceptable not to be knowledgeable about safety (even in an aviation domain) and where discussion that is left to experts creates an experience of exclusivity and a fear of appearing ignorant.

Multi-faceted organizational learning is the main demand that line managers express from a knowledge management perspective. The learning from critical incidents starts for these managers with a

continuous clarification of the just culture and non-punitive concepts. Their argument is that against the backdrop of a non-explicit and reiterated corporate message there is an array of role players that have to share and apply their own interpretation when a report is submitted, an investigation conducted and corporate communication drafted on incidents and associated lessons learned. The focus group responses provided the richest explanations that unpacked the drivers (or lack of) of knowledge management. The sub-themes are listed for completeness:

- Access to safety or incident related information limited by infrastructure;

- The volume of information experienced as overwhelming;

- The process of investigation or what happens to reported information was a grey area;

- At times the purpose of an incident investigation appears as mere routine;

- Lastly, systemic failures are not captured by the system or analyzed in a trend like fashion.

An additional theme to knowledge management is also highlighted by focus groups (and investigated reporters), namely inhibited information flow. This theme is mainly informed by underreporting originating from student pilot error being overlooked, the sheer volume of incidents, and, operator efficiencies that mask such industry deficiencies.

3.1.6   Incentivized reporting

Interestingly, only line managers and investigative reporters raised the theme of incentivized reporting. Line managers see a reporting behavior benefit in actively and consciously searching for success stories that will promote reporting and act as a driver to a purpose driven system. Unfortunately, investigated reporters show cynicism towards the corporate incentive scheme that is experienced as distorted because of its monetary implication. The focus groups showcase reporting as an inherent part of the job where incentives are redundant.

3.1.7   System view

According to senior level managers the road to improving reporting behavior in an organization is neither clear nor simple. There is a realization though that it is a journey that is mostly seen as a safety management journey and not just applicable to reporting per se. Their focus though has an apparent corporate risk, "*I don't know if it's fear but some concern on the part of the employees because um, I guess um, ultimately there is still a risk to an individual repeatedly experiencing occurrences of a similar*

nature because that talks to the person's ability to do the job, and um, regrettably we have to manage risk…"

Line managers add to the notion raised by senior management that illustrates with thematic clarity that the safety ratio takes precedence over the act and purpose of reporting in every occasion.

3.1.8 Shared accountability

The role of senior management when it comes to safety is expressed in a twofold understanding of: firstly educating support services managers on their safety role, and secondly a communication role of reported incidents while refraining from influencing the tasks of incident investigations. Moreover senior managers see the safety business as an unforgiving business *"…because controllers always say to you, you know the guy pushing tin we work millions of airplanes, and we have one little mid-air, and nobody forgets it." "Yet if we should happen to have a very severe incident or accident, I would imagine I'd be in the doc for this company with my colleagues. So I try and prevent that for two reasons. The one is to protect my [me], to protect [the ANSP] and strangely enough to protect the individual. If I know there's a controller out there gunning for an accident I need to stop him from hurting people and himself."*

On the other hand, line managers see their role as expectation management. This, for line managers, means being consistent in responding to incident reports and continuously engaging in discussion with operators on safety matters.

The focus groups provide an extended spectrum of sub-themes to inform the theme of human inclusivity in the shared accountability domain. For starters, the immediate social environment (peers) of a reporter heavily influences reporting or underreporting where the stance of senior ATCs play a prominent role. Secondly, personal contact and the relationship with a line manager is experienced as pivotal to reporting and inclusivity, i.e. overreaction as much as a lack of reaction to reports influence future reporting behavior. Thirdly, in a complementary fashion to inclusivity, the operators express a desire to be recognized for the emotional labor of reporting (including peer reporting) and the desire to add value.

Reporters bring a new dimension of asymmetrical power to the construct of reporting. Truncated industry responses to pilot error are experienced as pilot superiority. Moreover, asymmetrical power is also evident, sometimes unintendedly so, when reporting is inhibited in the interest of self-preservation or protection of peers or upholding the ATSU safety record.

3.1.9 Trust

Every system response to an incident report that differs from the previous response acts as a re-enforcer of a belief that the system cannot be trusted to deal with incident reports consistently. As a result,

the topic of fairness automatically flairs up as a point of contention. Contextually, trust emerged as a product in the safety system and not a behavior driver or theme because reporting heavily relied on relationships amongst peers as well as hierarchical relationships.

3.1.10   Relationship based reporting

The sentiment of senior level managers is that the emotional involvement and the personal stake of reporters has to be recognized. The most unexpected theme that emerges at this level is that of self-preservation translated from the apprehension to not appear sedentary in responding to an incident.

On the other hand, the line managers depict their competing challenges of countering the perceived downward distrust and building a relationship with operators that displays a trust in their judgment and ability to manage operational safety. Framing the scenario is as important to kindle the psychological contract "… *just ask controllers to give you a little more detail, I'm unsure about what happened and that's that. Don't go now and point a finger, that's where the problem comes in.*"

This act of engagement is also interpreted as an achievement by line managers when operators verbally report possible incidents directly to their line manager (as appose to submitting written reports first). Focus groups illustrate another dimension to relationships where peer reporting is categorized as socially unacceptable behavior or a culturally embedded code of silence (King & Scudder, 2013), e.g. not looking after the interest of a peer.

What changes the face of reporting, reporting cultures and reporting systems is the reality that different organizational levels have diverging views, approaches and understandings of the system as well as their role in the construct of critical incident reporting. These realities illustrate overlapping themes that are inter- and intra-related while influencing each other in a multitude of directions as reflected in Figure 1. The interconnectedness and dependencies of these themes can of course have far reaching effects in a system that is fluid, despite being considered a highly regulated environment. What is also illustrated in Figure 1 is the intricate complexity that involves a reporting system within the greater safety management system and the organization within its own industry and even beyond.
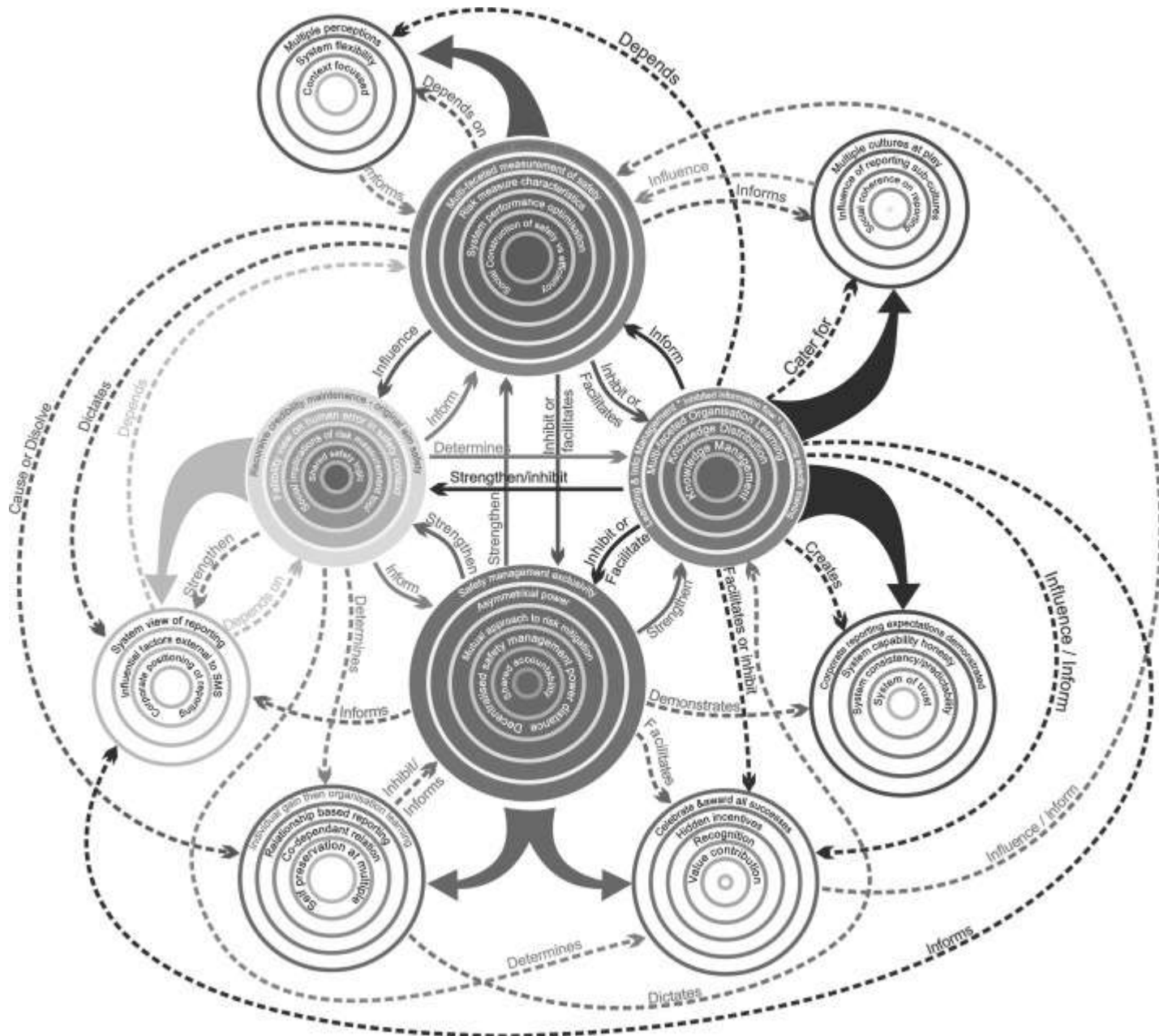
Figure 1.

Interrelated reporting system themes that influences behavior across organizational levels

4.   Discussion

4.1   Safety ratio and safety data

The data show that the interpreted centrality of the safety ratio is the greatest dilemma creating unintended reporting behavior. This single linear measure of safety shows interesting and in some ways unexpected factors that spillover into reporting behavior. The greatest price of the safety ratio that

surfaced across the four organizational levels or data sets, is its distraction away from system optimization as a core focus of a SMS.

On an industry level, the sheer multitude of incidents has a direct effect on internal reporting behavior. And, despite a corporate policy stipulating a "Just Culture", the actual application of organizational justice changes every time that a manager or investigator changes, if not actively calibrated. Mihelic and Culiberg (2014) find this to be a moral attentiveness that influences ethical judgment which in turn affects intention.

The ANSP has a well embedded practice of continuous dissemination of incident related information that is important from a reporting perspective, although the essence of managing knowledge for safety purposes is not captured nor internalized from the operator's perspective.

4.2 Corporate Positioning

The systems view of safety (including reporting) required and that includes positioning of reporting within the organization lacks clear articulation that almost appears to filtrates or trickle down to an element of disempowerment within the broader spectrum of organizational life.

Shared accountability is expressed by all four groups and a synergy emerges from a systemic need that desires a decentralized power distance informed by a safety accountability. The main driver of such decentralized safety governance beyond organizational structures though is strongly informed by interpersonal relationships that appear to be underestimated as a theme. This is of paramount importance from a scholarly as well as a safety management perspective because the system should develop the understanding of how the power changes 'hands' through the daily activities of reporting. The power in withholding a report, the power of a line manager when receiving a report and the authenticity embedded in sharing the lessons from an investigation report should be consciously done to signal the safety. These decisions and reactions of course influences the relationship required for mature reporting behavior on a daily basis – a fluidity that becomes a systemic risk when it is easier to respond in a fashion that assumes control over human error and reporting behavior.

4.3 Reporting in social context

The first question posed in the introduction can now be answered: Critical incident reporting has a collective, inter-subjective and connectionist dimension that should be understood as "reporting-in-social-context". In the results section it was noted how personal impact is a central consideration for reporting related behavior regardless of a person's level in the organization. Obviously the context vary although the theme of self-preservation remains as a driver of behavior. This links with the risk measure characteristics that appears to always contain some dimension of personal vested interest. Regrettably it is

usually linked to personal loss. This loss is either financial through a bonus or emotional through peer perceptions of incompetence. The theoretical model in Figure 1 illustrates this well where the risk measure characteristics have multiple influences and are influenced by numerous parts of the safety management system and organizational behavior. The complex reporting reality depicted in Figure 1 is of course oversimplified when the ANSP focus on reporting only as a source of reportable statistics (Tourtier et al., 2012).

According to the findings of Leap (1994), this tendency is driven by what corporate boards expect from safety related industry leadership teams, i.e., the design of a measurable safety metric. Very soon this becomes the one-dimensional focus point that trickles down the leadership spine. In some instances, as with this study, Yamamoto (2008) found that the demand causes biased parameters to be set by either law makers or society. Think for example how doctors, pilots and ATCs are portrayed by the media and local law enforcement following a human error related accident (Cha, 2016; Phillips, 2016).

In an attempt to remain accountable to the industry or public, the organization and at times the industry design a reporting system that evolves into what Battles et al. (1998) calls a "mandatory expectation" that diverts attention away from the actual contributory factors to critical incidents in a transfusion medicine environment or the disciplinary code of the ANSP in this study.

In other words, little attention if any is paid to contextual conditions as found by Patil et al., (2012) where frequency and severity alone becomes the only safety measure. This swiftly becomes a tainted safety philosophy that contradicts the reality of human fallibility.

It is important to note that we are not discrediting the measure of reports and severity of incidents but are rather arguing that it should be part of a more comprehensive matrix of measure that includes local operator involvement as well as actions taken to improve the system's safety performance at a local level. We echo a finding by Leva (2010) where operators emphasized the value of including the crew in dissecting an incident with facts and contextual factors. Two other studies have found such involvement critical in promoting reporting as a result of the prominence of norms and local knowledge (Brown, Willis & Prussia, 2000) as well as the benefit where operators favor confidential reporting that enables direct interaction and feedback to the reporter (Anderson et al., 2002). The latter allows for an appropriate understanding and storyline that spills over into a learning opportunity. Nonetheless this narrative requires a relationship that was not experienced in this study due to a lack of consistency in responses to reporting.

This ANSP was in no way unique. Other operators experience similar contributors to underreporting as did Nicholson and Tait (2002), where the reporter is blistered on fallibility and senior leadership sets the tone through a "can do" culture. This phenomenon is strengthened by feedback only given at an individual level. However, Dekker (2016) promotes the importance of rather providing

feedback from a systemic point view that can counter the need for self-preservation that both the operator and management both display in avoiding the downward perception of incompetence.

It is this distorted focus on the human fallibility that inhibits learning and subsequently the knowledge management component of the theoretical model. According to Benn et al. (2009), what is actually required is an organizational culture that facilitates the ability to recognize the impact of latent system conditions and contextual factors through incident reporting.

What this study therefore reflects is that reporting as a part of a safety system is connected through a multitude of actions, interpretations, decision making processes and perceptions as well as intent that has to be understood from the "human within the system" point of view. In other words, the human interaction within the system creates multiple realities that depend on a well geared reporting system but that are influenced by more than just a reporting platform and investigation procedure.

4.4   Organizational levels of context

The foregoing discussion also allows us to comment on the second question noted earlier in this paper: Does an assessment of a reporting system depend on social context, system history and local information constructed at each organizational level?

Although the data shows that senior management is conscious of possible underreporting, there are confidence in pilot reports and peer reporting that will counter underreporting. Although, Wagner et al. (2012) discovered that operators that have never reported an incident are 1.5 times less likely to admit to serious error that should be reported. As a result, the existence of underreporting is admitted by focus group respondents while leadership behavior is sighted as the main factor that discourages reporting. These factors appear very similar to those of Brown et al. (2000) that range from manager assumptions about causal factors of incidents to avoiding the reactions of more vocal managers who overreact to reports. This simply decodes into the emotional labor[4] of reporting and the inappropriate measures of safety that inhibits reporting.

Peer reporting in itself is considered an inappropriate behavior in most instances and according to respondents never gets reported formally. Firth-Cozen et al. (2004) find in the medical industry that those considered clinically efficient are treated with greater tolerance and this thus gives rise to underreporting, which was also echoes in this study. Moreover, peer-based inefficiency is usually reported to a line manager in verbal format but in very few occasions considered as suitably dealt with by the line manager.

The friction is clearly visible between incident investigations and the ANSPs safety policy in relation to the expectations and challenges placed on the operator. Although managers defend their stance

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[4] Emotional labor refers to the process by which workers are expected to manage their feelings in accordance with organizationally defined rules and guidelines (Wharton, 2009).

from the perspective of protecting the system and the individual, the focus on fallibility of course raises pertinent questions about the system itself, i.e. how the individual reached a point of validation to work solo in the first place. This is a sure way to distance an operator from the system intent of safety, especially when the outcome of investigations merely re-iterate the enforcement of procedures.

Finally, according to the second proposition then, safety related information is sensitive to the history of the system. This is because corporate communication, the messages from investigation reports and the demonstrated reception of reports by managers have their meaning situated in the interpretation by the recipients and not the intent of the sender. For this reason the study poses questions around two parts of not just reporting but also safety management, the first being around the integration of safety as a social construct within an SMS. The second topic is on the development of better integrated measures of safety. This can be especially interesting from the point of how the operator perceives the necessary measures as opposed to management and industry. The authors believe the solution may be found in a combination of these views and deserves attention in future research.

Therefore, from the perspective of the wider literature, the study sheds a theoretical light on a previously unexplored area within the construct of critical incident reporting: the influence and prominence of social constructionism within an operational context. This is achieved through an exploration across organizational levels not commonly compared. As a result, a new vocabulary is introduced to the debate of systems thinking in the safety space that goes beyond predictable linear relations to a theoretical model illustrating the intricacies of reporting behaviour intertwined with a safety management system.

On a practical level the research positions critical incident reporting and therefore reporting behaviour as a vital component of a safety management system that requires dedicated attentiveness. The theoretical model also provides an organisation or even an industry with a richer understanding and enablement potential of its existing SMS as a dynamic system.

5.   Limitations

The greatest limitation to the study is considered to be the single ANSP within the African aviation industry. Moreover, the study was performed by an ex-ATC who may introduce a particular frame of reference. In the future it may be valuable to explore how cultural differences may influence the social construction of reporting across different demographic groups, however no noticeable differences surfaced during this study within an existing multi-cultural environment (although it was not the primary focus of the study). It is suggested that future research empirically operationalise the themes within each data set to test the power of each theme within and across data organisational levels. Further research may

also test the relevancy of the themes within other complex, high-risk socio-technical organisations to determine the generalizability of drivers of reporting behaviour across industries such as mining, medical or nuclear industries.

6.   Conclusion

Reporting within the broader safety management system cannot be understood from only scrutinizing the reporting system design or the subsequent investigative and information dissemination processes. This study opens up new dimensions to reporting that illustrate constructed realities beyond hard-coded technical design of the system. The realisation of trickle-down and spill over effects showcases that a critical incident reporting system does not exist in isolation and regardless of how well the physical system may be designed, it remains sensitive to the behaviour of other stakeholders in the system -- sometimes those not even related to the actual reporting domain. The prominence of line and senior management centres attention away from the actual act of reporting into new spheres of influence. These roles may increase in magnitude when their primary focus adjusts towards knowledge management through engaged relationships that finds its impetus in the value contribution of reporting. Moreover, at the same time the centrality emphasis of the reporting system as a primary driver of a safety management system (from a source perspective) should not be underestimated when an SMS is reviewed or designed. This is potentially the difference between creating and preventing an organizational accident.

7.   Acknowledgements

8.   References

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