Characterising influences on safety culture in military aviation: a methodologically grounded approach

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Abstract

Historically, much effort has been expended in safety culture / climate research toward identifying a generic core set of components, predominately using the self-administered questionnaire approach. However, no stable unified model has emerged, and much of this research has taken a methodologically top-down approach to depicting organisational safety culture. In light of this, the benefits of qualitative exploration as a precursor to and foundation for the development of quantitative climate measures are increasingly recognised. When grounded in the viewpoint of employees, qualitative data driven techniques can provide an insight into how those within an organisation make sense of their work environment and how this impacts their understanding of safety. The current research aimed to address issues of ecological validity by using a qualitative approach to exploring and characterising military aviation employee perspectives on safety culture and risk taking prior to development of a quantitative measurement tool. A thematic analysis of twelve focus groups (N=89), conducted with military employees in a semi-structured manner, was undertaken. This insight into how these personnel interpret their working world was characterised by six nameable constructs: 1. Policy and procedures, 2. Pressure, 3. Management ownership of safety, 4. Individual responsibility and risk perception, 5. Communication and 6. Organisational commitment. Interpretation of these constructs and implications for the future development of a quantitative measurement tool are discussed.

Introduction

Despite intense research interest over the past three decades, the theoretical basis for the concept of safety culture remains indistinct (Kim & Wang, 2009). Efforts toward development of a generic set of components to characterise safety culture have proved generally unsuccessful (Guldenmund, 2007); findings and exploitation of safety culture research have tended to be inconsistent (Cox & Flin, 1998; Pidgeon, 1998) and increasingly fragmented. This lack of consistency in research findings supports the supposition that understanding of safety has a high contextual specificity, where generic measure approaches will have little utility (Jeffcott et al.,

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2006). The lack of a universally accepted definition of safety culture and its boundaries are likely to exacerbate these inconsistencies.

Safety culture-common constructs

Safety culture research is dominated by psychometrically derived tools designed to measure a multi-dimensional construct. However, studies vary considerably in the number and content of these definitions (Guldenmund, 2007). In an effort to coalesce this research Flin et al. (2000) consider common headline variables through interpretation of (often idiosyncratically labelled) constructs. Common variables identified include management commitment, workforce involvement, training / communication, employee risk perception, nature of the work environment and policy / procedures. Many safety climate questionnaire tools have taken a methodologically top down approach to development, often based on already existing measures or constructs (Cox and Flin, 1998), which often date back to seminal work in this area (Zohar, 1980). Top-down measurement development has been criticised for running the risk of imposing theoretical concepts and underplaying the potential for social difference (Seo et al., 2004), with negative implications for instrument validity which has proved elusive for many instruments across sectors or professions (Guldenmund, 2000).

The benefits of data driven approaches, grounded in employee perspectives, are claimed to have the potential to cast light on how factors impact culture, and in what ways identified variables influence employee decision making and behaviour in relation to risk (Cox & Flin, 1998; Weyman et al., 2006). There are, as yet, only a small number of published studies using qualitative methods (Jeffcott et al., 2006; Blazsin & Guldenmund, 2015; Nordlof et al., 2015), however the rich detail in these provides contextual insight into understanding of safety culture within their respective organisations.

Safety culture in aviation

Aviation has received a great deal of interest in this area (McDonald et al., 2000; Falconer, 2006; Petterson & Aase, 2008; Goodheart & Smith, 2014), however even within this industry there is a lack of convergence on common constructs (O'Conner et al., 2011). Understanding military attitudes to safety and risk are important given the requirement for these personnel to have a positive attitude toward safety yet willing to take risks (Borjessin et al., 2011). This is dissimilar to civilian life, in which much of the safety culture research is grounded, although many of the regulatory and legislative requirements may be common to both. The interplay of military requirements and regulatory policy may result in different interpretations of safety than have previously been identified in civilian studies (Turner & Tennant, 2009). The Defence Aviation Environment (DAE) has undergone considerable changes in recent years as a result of recommendations made in the Nimrod Review (Haddon Cave, 2009), a detailed investigation into the loss of the Nimrod MR2 XV230 aircraft in 2006. Implementation of these recommendations has resulted in changes to risk ownership structures, processes associated with safety management, regulatory authorities and error management (Ministry of Defence, 2012) while safety culture has become a key focus as a result.

Materials and methods

The aim of the current research was to use qualitative methods to enhance insight into defining influences on safety culture and risk taking within a military aviation context and to use this as the basis for the development of a more ecologically grounded and valid quantitative safety climate measurement tool. The study reported here relates to findings from initial foundation qualitative research.

Study design

An exploratory, qualitative approach was adopted for the current study. As the focus was on shared understanding of factors related to safety, focus groups were selected as the method of enquiry. This method has several advantages; it provides insight into shared sense making, norms, values and attitudes, facilitates group dynamics to allow synergistic amalgamation of ideas (Kitzinger & Barbour, 1999) and allows the complexity of employee experience to be captured (Jeffcott et al., 2006). A semi structured interview schedule was developed through discussion with subject matter experts (SMEs) within the organisation, as well as the findings from previous studies and the wider safety culture / climate literature.

Participants and recruitment strategy

The study was undertaken with ethical approval from both the Ministry of Defence Research Ethics Committee (MODREC) and the University of Bath. Participants were an opportunity sample of military personnel attending safety training courses. Twelve focus group sessions were conducted, lasting between forty five and sixty minutes. The sample (N=89) was predominately aircrew (such as pilots) and aircraft maintainers (known broadly as engineers), with a small number of Air Traffic Control (ATC) personnel. Details of the samples can be seen in Table 1.

Table 1. Trade and number of participants in focus group sessions

Focus group	Trade	Number of participants
1	Engineer	9
2	Aircrew	8
3	Engineer	6
4	Aircrew	9
5	Engineer/Air Traffic Control	5
6	Aircrew	9
7	Aircrew	7
8	Engineer	6
9	Engineer	6
10	Engineer	5
11	Engineer	11
12	Engineer	8

As personnel in these three departments were unlikely to interact during their normal work, it was decided to conduct the departmental groups separately. As there were only a small number of ATC personnel, they were accommodated within a focus

group with Engineering personnel. In accordance with the ethical protocol, participants were volunteers, fully briefed prior to consent, able to withdraw at any time and assured confidentiality. The main author facilitated the focus groups, and an assistant took notes.

Data analysis

The sessions were audio recorded and transcribed verbatim. Thematic analysis was selected to explore the data as it is well suited to identifying, analysing and reporting patterns in the data (Braun and Clarke, 2006) while accommodating interpretation of the research topic (Boyatzis, 1998). The analysis was both empirically and theoretically driven, with all themes being grounded in data provided by participants (Biggs et al., 2013).

The analysis process was guided by methods described by Braun and Clarke (2006). Steps were reviewed iteratively and the method of constant comparative analysis (Glaser and Strauss, 1967) was used to encourage conceptualisation of the relationships between the data (Thorne, 2000). The transcripts were imported into the Nvivo 9 software where initial analysis and coding of the data on a small number of transcripts (N=2) were undertaken independently by the first author and an assistant, after which differences in classification and interpretation were discussed to challenge assumptions. Iterative cycles of grouping initial codes into clusters and subsequently themes resulted in a thematic framework. On completion of this thematic framework, an inter-rater reliability assessment was undertaken on sample transcripts (N=3). Cohen's kappa statistic was used to assess the degree of concordance which resulted in a coefficient of 0.62. The definition and boundaries of the themes was revisited, with a subsequent assessment returning a coefficient of 0.72.

Results & Discussion

Thematic analysis of the focus group data resulted in identification of six nameable themes that are considered to characterise how these military aviation employees articulate headline influences on workplace safety culture and risk taking (Table 2). Each theme embodied a number of related facets which will be discussed in more detail. Illustrative quotes from the focus group sessions are identified in *"italics*", with clarification notes in (parentheses) and the author's occupational group in [square brackets]. Given the difference in nature of both the work environment and the work tasks carried out by Aircrew and Engineers, it was considered important to note any differences between these groups during the thematic analysis. Within this section, where themes were applied, or interpreted differently between the two groups, this is noted. The small number of ATC participants meant that a similar comparison could not be made with this group when considering the themes identified.

Table 2. Themes and sub themes

Theme	Sub-theme
Policy & procedures	Legitimacy Barriers
Pressure	Organisational pressure Interdependence of functions
Management ownership of safety	Supervisory/line management Senior management
Individual responsibility & risk perception	Camaraderie Perceived consequences
Communication	Reporting Just culture
Organisational commitment	Pride

Policy and procedures

Respondents portrayed close adherence to policy and procedures as an accepted and strongly socially legitimised facet of the workplace context, playing a key role in safety perception and implementation throughout the organisation. This theme was apparent in all twelve focus groups and is considered to be characterised by two sub-themes, legitimacy and barriers. Respondents appeared to see policy and procedures as necessary and important, with adherence and compliance being imperative, this was interpreted as these having legitimacy. Sentiments expressed indicated that their legitimacy was enhanced by the belief that *"many of these rules….have been brought about because of accidents happening in the past, i.e. lessons learned"* [engineer]. This acceptance of the procedures was interpreted as positive, given the highly procedural nature of much of the work *"nearly everything that we do in aviation is very procedural"* [aircrew] which requires rule compliance to support the safety strategies (Hopkins, 2010). This is plausibly reinforced by the high consequences of failure and the cognitive availably of repercussions.

Despite the high legitimacy afforded, respondents juxtaposed this with descriptions of barriers to compliance. The most common of these was the claimed difficulty in keeping up to date with policy and procedures *"I don't think everybody necessarily knows exactly what procedures or what policies or regulations are necessarily applicable.."* [engineer]. This was attributed to the high volume and perceived constant alteration, with information spread across several sources *"Each week more policy comes out and everyone's expected to read it and take it in"* [engineer]. As a result, respondents portrayed themselves as vulnerable, in the sense of blame and accountability arising from inadvertent non-compliance. A lack of knowledge may lead to unintentional violations that are unrelated to inappropriate action or lack of motivation (Laurence, 2005), yet this has received little attention in the literature (Dahl, 2013).

Difficulties in compliance were also attributed to procedures that were lagging behind technical advances, changes that *"hadn't been acted on"* [engineer], and contradictory procedures which necessitate *"applying common sense"* [engineer]

were identified as further barriers. Involvement of frontline personnel in rule creation/alteration encourages compliance (Blazsin & Guldenmund, 2015). Changes should be acted on promptly as where inadequate, incompatible procedures are not changed in a flexible manner, locally accepted ways of working may result. This was evident in this organisation *"A lot of it has become the norm so you don't think about it…"* [engineer] which is a concern as this embodies an "*unknown risk"* [engineer], leading to situations where people *"may not really consider the implications"* [engineer] of what they are doing. Situations such as these may increase the potential for error and unintended circumstances (Reason, 1997) yet little is understood about how these 'norms' develop or can be managed.

Pressure

A general tension or trade-off between productivity and safety objectives has been identified in diverse industries (Weyman et al., 2003; O'Dea et al., 2010) and this has been a common thread in safety climate assessments (Flin et al., 2000). However, the definitions and sources of pressure vary between industries, and how these are communicated and interpreted may be context specific. In the current study non-compliance was generally seen as meeting with strong cultural and institutional disapproval *"I don't think many people, if any, would knowingly do that* (not adhere to standard operating procedures) *in this day and age"* [Aircrew], yet still two main sources of pressure were cast as being at odds with this. The first of these was allied to achieving organisational demands (called capability which can include defence, search and rescue, training and humanitarian efforts). The high perceived importance of capability was considered to be a shared group experience between respondents given the perceived common awareness that *"we are in the military-we have to be operationally effective, we have to have that capability"* [aircrew]. This pressure was considered to be implicit as personnel cast their experience as being highly conscious of their military purpose *"the reason we're here is defence of the country"*. Military work can be considered an outlier in comparison to civilian organisations, and the acceptance of risk may differ in training and routine tasks to combat activities (Turner & Tennant, 2009). This is arguably likely to affect views on safety that may not be reflected in the, predominately civilian, published research literature.

During routine tasks, safety was presented as often creating additional time pressure; *"a lot of this policy adds time on to jobs"* [engineer] both at team and individual levels, which was reinforced through management. For engineers particularly, failure to achieve these goals was described as risking reputational damage for individuals *"people believe they have to do a job in a certain time otherwise they will be looked at in a negative light"* [engineer] but also at a team and organisational level. This was evidenced in descriptions of the military 'can-do' attitude which has been observed elsewhere (Bosak et al., 2013). This attitude was presented as pervasive despite management directive to the contrary *"now the* (senior management) *has turned around and said I don't want you to have a can-do attitude"*. This may represent a difference between senior management command and local management implementation, or could highlight self-fulfilling attitudes, both of which would benefit from management consistency and open

communication. This type of pressure may lead to reduced attention to rules that are seen to impede progress, potentially circumventing a safety barrier (Bosak et al., 2013). Furthermore, in cases where a negative outcome does not occur, this may be incorrectly perceived as 'safe' and adopted again in future.

Management ownership of safety

A key construct in many safety culture assessments, good management involvement in safety has been shown to have a positive relationship with safety behaviours (Cheyne et al., 1998; Flin et al., 2000). The current study inductively identified two levels of management within respondent accounts. These two levels were the supervisory / line management level, and the senior management level, characterised by contrasting expectations and respondent experiences. Supervisors were seen as most influential in day to day business, being role models for appropriate behaviour *"The different techniques that people have to supervise and the way you've been taught and the procedures that they follow are passed on* (to subordinates)*"* [engineer] and passing on normative behaviour. These individuals are important in determining potential safety performance in personnel, making individuals *"more comfortable* (about) *being able to speak up"* [engineer]. Positive management behaviours have been seen to be important in determining compliance (Mearns et al., 1997; Simard & Marchand, 1997).

Contrastingly, senior management ownership was only discussed through impressions of primacy given to human factors and safety training and safety promotional material – this was cast positively as senior management support. Findings from other sectors suggest that senior management are under pressure to show that they are dedicated to safety (Biggs et al., 2013) and 'walk the walk', not just 'talk the talk'.

Individual responsibility and risk perception

Analysis of respondent accounts of their experiences showed a high, often intrinsically motivated, personal accountability for safety of oneself and one's colleagues *"we're our brother's keeper and look out for each other"* [aircrew] as well as the general public. Of note were references to small team size and general familiarity with colleagues as drivers of this safety awareness. This was interpreted as feelings of camaraderie – a sense of looking out for each other. Although this intrinsic motivation presented as strong, extrinsic motivation of legal responsibility for actions was also cast as important; personnel perceived personal liability as more pertinent due to changes borne out from the Nimrod report (Haddon Cave, 2009).

Respondent experiences suggested an inherent acceptance that aviation is a high risk activity and has the potential for severe consequences. Similar themes were observed in aviation personnel by Patankar (2003), suggesting an overarching industry wide risk perception may exist. Interestingly, while respondents accepted their involvement in high risk activities, this was cast as being managed through *"due risk assessment"* [engineer]; military activities are weighed against potential gains to operational capability (Turner & Tennant, 2009). This concept of

organisationally determined acceptable risks has not yet been discussed in the literature-further investigation may provide insights into understanding of safety culture.

Communication

Communication about safety issues was presented by respondents as required to encourage organisational learning, such as using reported mistakes as *"really good learning tools"* [engineer]. However, despite acknowledged management encouragement, some respondents claimed a *"stigma of being labelled"* if they were to self-report mistakes. The embarrassment of admitting a mistake may affect behaviour, even in employees who acknowledge the importance of reporting (Nordlof et al., 2015). In Defence Aviation, the concept of a 'just culture' (treating individuals in a fair and consistent manner and applying appropriate sanctions) is promoted in order to encourage reporting - this concept has been widely encouraged and promulgated in communications in the study organisation.

It was this issue of 'just culture' in which it was identified that perceptions may diverge along functional boundaries. Differences between experiences of Aircrew and Engineers were noted. Aircrew generally agreed that *"we know we must admit a mistake, that we must learn from it and that we will only get punished if we have absolutely contravened regulation"* [aircrew] while many aircrew suggested that this may be different for the engineering function. This was partially supported, with a suggestion that the just culture was *"more alive and well at the top of the chain, but less so at the bottom*" [engineer], but this discussion did not extend to the junior engineers. Given the institutional requirement to report safety related incidents, it is unlikely that people would admit to under-reporting, yet there are indications that perceptions of the just culture concept may not be homogenous. This concept of sub cultures is increasingly being acknowledged in safety culture research (Antonsen, 2009), with cultural boundaries being identified between functional departments or specialisations (Gherardi et al., 1998; Mearns et al., 1998; Richter & Koch, 2004).

Organisational commitment

The final identified theme was named organisational commitment and was defined as the shared sense of safety purpose between employees, a sense of belonging to a group. This manifested through discussions about pride in the safety reputation of the organisation *"I think we all see it as our heritage…and we would never try and put a negative view on it"* [aircrew] where safety was cast as an integral part of the organisation which was instilled early on in personnel training *"it's been so engrained from the time that you join that it's something that becomes second nature to you"* [engineer]. This was summarised by one respondent suggesting that *"Safety reputation…is all important- we think we're reasonably safe, but not complacent"*. Similar findings have not been explored in many safety culture measurement tools, however a similar construct named 'Pride in company' was found by Patankar (2003) using statements such as 'I am proud to work for this company' and 'My company is the best in the business'.

Conclusion

The grounded approach to characterising safety culture in a military aviation population has provided insights that support the requirement for contextualisation of safety culture. These insights will be used to support the development of an ecologically valid quantitative safety climate measurement tool. In contrast to other sectors, policy and procedures were shown to have high legitimacy, despite some organisational barriers to compliance being identified. Exploration of employee interpretation of the priority of organisational goals and potential sub-cultural differences will be facilitated through a more quantitative tool to determine the generalizability of these findings to a wider sample. The study may be limited by the separation of Aircrew and Engineering participants into separate groups. Participants were therefore able to discuss shared experiences, but potential differences between these groups may be better identified through combining these functions into a single focus group. The identified themes would benefit from future application of psychometric techniques to test the suitability of novel themes (such as the high level of commitment to organisational safety reputation and integration of safety awareness throughout the military aviation career) and previously established themes (such as management commitment and policy & procedures) as constructs underpinning safety culture.

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