Safety Culture in Defence Explosive Ordnance: Developing a Safety Climate Measure

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Abstract

It is increasingly recognised within high-consequence industries that a positive safety culture is strongly linked to various safety outcomes and performance indicators. Explosive ordnance (EO) is an area that demands a high level of safety culture, indeed it is a reputational and operational necessity. This paper introduces a measure of safety climate tailored to the EO domain. The paper describes the background to the study, the development of items, and the subsequent factorial validation of scales on the basis of a sample of 272 EO personnel. The factor structure that emerged was very similar to the postulated structure of 14 climate dimensions. These 14 dimensions were shown to represent three meta-themes in the data: Safety Awareness and Responsibility (8 subscales), Safety Resources issues (3 subscales), and Safety System issues (3 subscales). The authors are confident that the EO Safety Survey is a valid, reliable and powerful tool that will support the goal of holistic reform of the EO domain. The EO Safety Survey will inform and enable tailored safety intervention efforts, improved compliance monitoring, and benchmarking studies that, collectively, will enhance the management of the human factors issues that impact on EO work.

Introduction

Safety in explosive ordnance is a reputational and operational necessity. The regulation of EO has a long history, dating back to the eleventh century when gunpowder was first imported to the West from China. While it is hoped that catastrophic damage and loss of life from EO mishaps are unlikely, it is apparent that even small safety incidents can have potentially strategic implications for Defence. Such events can trigger suspensions of equipment use, suspensions and reviews of training, and detailed, costly and time-consuming investigations. The conduct of operations can also be affected.

It is increasingly recognised within high-consequence industries that a positive safety culture is strongly linked to various safety outcomes and performance indicators. This interest in safety culture is associated with the need to transform “the way people do business” to more desirable - and safety-friendly – states. In aviation, the International Civil Aviation Organisation has mandated that all member states must implement safety management systems. Further, these safety management systems must include a component aimed at improving safety culture. Many other high-risk industries are following aviation's lead by seeking to assess and improve safety culture. Safety culture is a relatively new area of research so our understanding of safety culture is still evolving, as are the tools used to assess it.

Reason (1997) proposed that an organisation with an effective safety culture: a) has a safety information system that collects, analyses and disseminates information from incidents and near misses; b) has a reporting culture where people are prepared to report their errors,

mistakes and violations; c) has a culture of trust; d) is flexible and able to adapt to changing cirumstances; e) is willing to implement reform when it is required.

While culture is regarded as quite stable, climate is considered quite dynamic. Nevertheless, climate is considered easier to measure because it comprises those elements - attitudes, perceptions, opinions and behaviours – that psychologists and sociologists have been measuring for decades (Mearns, Whitaker, & Flynn, 2001). Safety climate, because it is more amenable to measurement, and precisely because it is more ephemeral, is considered the logical target for safety interventions. Safety climate can predict safety outcomes (Johnson, 2007). Given the multifaceted, multilevel complexity of safety climate, multiple measurement methods are recommended to generate comprehensive understanding.

A task to develop a measure of safety climate tailored to the EO domain was commenced in the Australian Defence Force in March 2010. The main aims of this measure include the ability to: a) compare scores across sections of the organisation to determine where intervention efforts should be directed (graphical representation provided); b) obtain qualitative data for improving compliance with EO procedures; and c) collect information that will, over time, provide benchmark data that can be used to help manage human factors issues that have an impact on EO work.

Method

Components of the task included: a) the conduct of focus groups with EO operators and subject matter experts; b) the design and pilot testing of the EO Safety Survey; c) the review of existing safety performance data; d) administration of the survey in May 2010; and e) analysis of the data from the returned surveys.

Themes that emerged during the focus group sessions included documentation issues; inadequate manning, downsizing, and insufficient resources (resulting in high, stressful and, in some cases, potentially unsafe workloads); outdated EO policy and procedures; declining basic knowledge and awareness of EO; situational and occupational differences; a perceived decline in the organisation's inbuilt defences that mitigate mistakes and errors before they lead to incidents; unqualified personnel being used in EO roles; management pressure to get things done, administrative decision-making in ignorance of EO technicalities, training issues, and communication concerns.

The Explosive Ordnance Safety Culture Survey (EOSCS) was based on a literature review, the focus group outcomes, and the professional experience of the consultants in designing and administering surveys of this kind in military aviation, mining, construction, and civil health settings (Fogarty & Shaw, 2010; Murphy, 2009).

The EOSCS comprised five sections: a) background information on employment status, years of explosive ordnance experience, main and secondary explosive ordnance role(s), work satisfaction, and job intentions; b) the second section contained a 78-item scale measuring 14 dimensions of safety attitudes, perceptions and behaviours and a 10-item error scale; c) section three of the survey contained 20 items drawn largely from the focus group discussions that were intended to measure attitudes to topical issues related to explosive ordnance safety; d) the fourth section included variables often associated with safety including measures of workplace morale and cohesion, fatigue, various health indicators, including psychological status, and some basic demographic items; e) the final section of the survey provided a page for written comments about any aspect of the survey.

A total of 272 surveys were administered. Four surveys were discarded during verification and a further 31 surveys were excluded from the current round of analyses because the respondents lacked meaningful exposure to explosive ordnance.

Results

Following data screening procedures, Principal Axis Factoring methods embedded in the SPSS programme were used to assess the dimensionality of the instrument. Horn's (1965) parallel analysis routines were used to determine the number of factors to extract and axes were permitted to rotate to oblique positions. Cronbach's alpha coefficient was used as to estimate internal consistency reliability. The EO Safety Climate Scale proved to be a valid and reliable measure. The factor structure that emerged from analysis of the items was very similar to the postulated structure of 14 climate dimensions. These dimensions were: Safety Communication, Safety Awareness, Quality of Supervision, Willingness to Report, Organisational Compliance, Manageable Workload, Adequacy of Resources, Consequences of Mistakes ('just culture'), Individual Compliance, Training Standards, Quality of Documentation, Excessive Documentation, Audit Comprehensiveness and Safety Commitment. These 14 dimensions were shown to represent three meta-themes in the data: Safety Awareness and Responsibility (8 subscales), Safety Resources issues (3 subscales), and Safety System issues (3 subscales).

Conclusions

The authors are confident that the EO Safety Survey is a valid, reliable and powerful tool that will support the goal of holistic reform of the EO domain. The EO Safety Survey will inform and enable tailored safety intervention efforts, improved compliance monitoring, and benchmarking studies that, collectively, will enhance the management of the human factors issues that impact on EO work

Safety climate and culture need to be underpinned by an awareness of relevant safety and human performance concepts so that a shared language relating to safety management is developed. There would appear to be scope to increase the awareness of human factors and safety management systems across the Defence explosive ordnance domain. As mentioned above, human factors training is now mandatory in aviation. Safety systems must also be underpinned by an effective reporting system, willingness to report, and a 'just culture' that promotes individual and corporate safety responsibilities.

References

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