Journal of Air Transport Management 63 (2017) 95–107

Contents lists available at ScienceDirect

Journal of Air Transport Management

journal homepage: www.elsevier.com/locate/jairtraman

A holistic approach to evaluating the effect of safety barriers on the performance of safety reporting systems in aviation organisations

Muhammad Jausan*, Jose Silva, Roberto Sabatini

RMIT University, School of Engineering – Aerospace and Aviation Discipline, Melbourne, VIC 3000, Australia

ARTICLE INFO

Article history:
Received 1 February 2017
Received in revised form
25 May 2017
Accepted 20 June 2017

Keywords:
Safety reporting system
Safety barriers
Safety performance
PLS-SEM
Aviation
Safety management systems

ABSTRACT

Safety reporting systems are a necessary component of any Safety Management System (SMS) in contemporary aviation organisations. Improving the performance of safety reporting systems can significantly enhance the reliability of safety information and allow the implementation of more effective risk assessment processes. Previous researchers have identified several barriers that influence the effectiveness of safety reporting systems, ranging from individual barriers to organisational issues. However, none of these studies has addressed the concomitant effect of the different barriers as a means of determining the overall effect on the performance of existing reporting systems. This paper proposes a holistic approach to this problem by developing a model that can help to determine the cumulative effect of organisational, working environment and individual barriers on the performance of a safety reporting system in an aviation organisation. The Partial Least Squares Structural Equation Modelling (PLS-SEM) technique was used to examine the relationships amongst the different variables considered in our study. The model was constructed using a broad range of data collected from a survey conducted in a military aviation organisation, with the purpose of identifying the barriers to reporting in this particular context. Results show that the proposed model allows to accurately quantify the impact of the various concomitant barriers in the reporting system, providing a powerful resource to assist stakeholders in the decision-making process that is inherent to the implementation of tailored actions to improve the safety performance of aviation organisations.

1. Introduction

The adoption of an effective safety reporting system is one of the fundamental tools required for the correct implementation of an aviation Safety Management System (SMS). A reporting system allows an organisation to collect accurate information related to hazards, incidents or accidents in a timely manner (ICAO, 2013). Those reports are very useful as they provide managers and decision-makers with critical information on hazardous situations, which are often privy to individuals working at the front line of high-risk organisations. Based on these various reports of both minor and major safety-critical events, appropriate recommendations and preemptive actions can then be applied to prevent identical occurrences in the future, thus contributing to a substantial improvement of the overall safety performance of the organisation.

Having an effective reporting system in place is also instrumental in fostering a sound reporting culture in aviation organisations by raising awareness amongst all staff members of the hazards inherent to their operations and how their active reporting attitude can contribute to an effective identification of safety breaches across all organisational layers. Reason (1998) revealed that at the heart of any mature safety culture lies an informed culture which requires the co-existence of an effective reporting culture. This, in turn, must be underpinned by a fair (or just) safety culture whereby employees felt free and encouraged to report their concerns or formulate suggestions without any fears of consequences. It is evident that this climate of trust can only be promoted by establishing clear boundaries between acceptable and unacceptable behaviours.

However, despite the efforts and investments of several organisations in voluntary, confidential and non-punitive reporting systems in recent years, safety reporting systems are often underperforming as they fail to capture information concerning a significant number of minor occurrences or safety deficiencies across

* Corresponding author.
E-mail address: s3494174@student.rmit.edu.au (M. Jausan).

http://dx.doi.org/10.1016/j.jairtraman.2017.06.004
0969-6997/

the different levels of an organisation. Aviation authorities have recognised this problem and raised awareness of the importance of improving the performance of reporting systems to ensure that these can be a useful instrument for the collection of safety data (ATSB, 2012, 2014; EASA, 2012). Several researchers have drawn similar conclusions and prompted the high degree of under-reporting of safety occurrences in aviation (Darveau, 2015; Gilbey et al., 2015; Murawski and Supplee, 2008; Phillips and Talley, 1992; Tani, 2010). Furthermore, other industry sectors such as healthcare, chemical, energy and shipping that also make use of reporting systems as integral parts of either safety or quality programs, have also been affected by under-reporting of many data on incidents and hazards, largely as a result of various concomitant factors (Ashcroft et al., 2006; Barach and Small, 2000; Clarke, 1998; Cullen et al., 1995; Grootheest, 1999; Mahajan, 2010; Pronovost et al., 2009).

Considering the observed similarities of the reporting systems in place across different industry sectors, several studies have been conducted to assess the many barriers precluding an optimal performance of safety reporting systems. However, most of these studies tend to focus on the effect of isolated parameters rather than assessing the concomitant effect of different barriers existing at various levels and acting concurrently in an organisation. In fact, it is crucial to have a broad picture of the key barriers in an organisation that contribute to the suboptimal performance of safety reporting systems as these are often interrelated and complex. Several studies have highlighted how the performance of safety reporting systems can result from a myriad of factors spanning multiple levels in the organisational hierarchy, from the top to the bottom layers (Lucas, 1991; Reason, 1997; Rodrigues and Cusick, 2015). Another limitation of existing studies in this area is that they are essentially based on qualitative methods and seldom provide an accurate weighing of the various barriers contributing to the underperformance of reporting systems.

The model proposed in this paper classifies all common barriers to safety reporting into three main categories, allowing the establishment of clear relationships between the main barriers and how these impact the performance of the reporting system. The model is underpinned by well-known conceptual frameworks used in the aviation safety domain, namely the concept of organisational factors proposed by Reason (1997), the taxonomy of human factors developed by Shappell and Wiegmann (2000) and the level of hierarchy in the socio-technical system proposed by Rasmussen (1997). The model is also inspired by previous work from Holden and Karsh (2005, 2007) who developed a pioneering framework describing the barriers to safety reporting in the healthcare sector.

In our research, data collected from dedicated surveys conducted in a military aviation organisation were quantitatively analysed using the structural equation modelling technique. This method provided an accurate assessment of the barriers and their impacts on the performance of the existing reporting system. The proposed model contributes to a better understanding of the current limitations of aviation safety reporting systems, allowing the introduction of effective improvements to the existing approaches and providing an answer to the ultimate aspiration of any SMS and ensuring a generative safety culture throughout all organisational levels and better risk management capabilities.

2. Research model development and hypotheses

To measure the influence of the various barriers on the performance of a safety reporting system, the model was developed taking into consideration the concurrent effect of the various barriers reported in the existing literature. These barriers have been demonstrated to have an identical effect across various high-risk industries that utilise reporting systems. The identification of weaknesses, gaps and potential sources of risks should be undertaken for all levels of a system or hierarchy (Rasmussen, 1997; Reason, 1997; Shappell and Wiegmann, 2000). Having this in mind, the model proposed in this paper was built upon three main categories of barriers influencing the performance of reporting systems: organisational, working environment and individual barriers.

Organisational barriers in this context comprise all barriers that might emerge as a result of top management (strategic level) activities. These include the development and publication of policies and procedures, allocation of resources (e.g., equipment, personnel and funding), ensuring compliance with regulations and policies and, finally, fostering a coordinated and proactive organisational culture. This latter aspect has many facets as different types of cultures can influence the values, beliefs, and behaviour of members of an organisation. Some of the main organisational barriers found in the literature include a lack of commitment from management, inadequate financial support, lack of an independent third party, lack of feedback or ineffective communication, inadequate (or inexistent) information technologies, and lack of professional development (Fig. 1).

The lack of commitment is generally associated with deficiencies in the top management's commitment to safety, which should be sound and clearly visible to both the collaborators (staff) of the organisation and external parties. If a safety culture is not ingrained in the organisation as a result of a consistent dedication by senior management, the likelihood of all employees voluntarily reporting safety occurrences will be compromised (Bridges, 2000; Phimister et al., 2003). The lack of financial priority given by top management to safety initiatives frequently results in inadequate resources being allocated to safety reporting systems. Hence, these will neither be able to capture information nor analyse it using appropriate methods or tools to provide a proactive identification of risks (Mitchell et al., 2016). The lack of an independent third party responsible for collecting and analysing safety reports has been recognised as one of the most significant barriers to voluntary reporting due to concerns regarding impartiality and confidentiality that might undermine the trust of would-be reporters (O'Leary and Chappell, 1996; Reason, 1997; Rodrigues and Cusick, 2015). The lack of feedback is essentially a communication issue pertaining to the absence of an action in response to the reporters' input, as well as the dissemination of recommendations or error reduction strategies learned from the collected data to all front-line personnel and the wider reporting community (Benn et al., 2009; Bridges, 2000; Darveau, 2015; Lucas, 1991; Rodrigues and Cusick, 2015). This problem can be aggravated by the lack of information technologies, or their inadequate use, which could otherwise contribute to an improved effectiveness of the reporting system as a result of a better interface environment and enhanced data management capabilities (Mitchell et al., 2016). Lastly, the lack of adequate professional development emerges as a prominent issue in those organisations that fail to provide sufficient training on the utilisation of reporting systems (Chiang et al., 2010).

The next category of barriers pertains to the working environment. These include all barriers associated with the observed environmental conditions in the organisation, such as information-processing factors that are related to attention, memory and knowledge, situational factors related to the ergonomic quality of the human-system interface, workload, distractors and the like, and lastly, the social and motivational factors which include attitude and group norms (Reason, 1993). To better articulate environmental barriers, the model developed in this research takes into account some more specific barriers that are typically related to the environmental context of reporters: the code of silence, inefficient