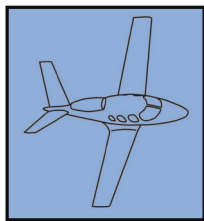


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Safety Professional's Perception of the Relationship Between Safety Management Systems and Safety Culture

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Abstract

The purpose of this qualitative study was to investigate the relationship between the elements/processes of safety management systems (SMSs) and their impact on safety culture at collegiate flight training institutions. Research questions addressed the following: different approaches to developing and implementing an SMS, different approaches to the assessment of safety culture, and the relationship between elements/processes of an SMS and a strong safety culture. A semistructured interview protocol was used. The researcher interviewed five safety professionals at U.S. collegiate flight training institutions of various sizes. Overall, the general consensus among the participants was that an SMS works best if it is implemented over time. A confidential hazard reporting system and the use of the five-step Safety Risk Management (SRM) process were viewed as important aspects to help build a strong safety culture. Other elements and processes were identified as having a strong relationship to safety culture as well. The participants revealed when their institution experienced a cultural change during SMS development. The study also provides recommendations for establishing a SMS.

Keywords: SMS, Safety Culture

Introduction

The development and adoption of safety management systems (SMSs) continues to gain momentum throughout the aviation industry. SMS is defined as “an organized approach to managing safety, including the necessary organizational structures, accountabilities, policies, and procedures” (International Civil Aviation Organization, 2013, pp. 1–2). Currently, SMSs are required for commercial air carriers, and it is anticipated that SMSs will be required for some airports. While SMSs are not required for flight schools, many safety professionals in the collegiate flight training environment have been developing and implementing SMSs for the past several years.

Safety professionals are the members of the organization typically responsible for the development and implementation of an SMS. The implementation of an SMS is usually time-consuming and involves the creation of milestones utilizing the elements and processes of SMSs as guiding principles. In 2010, the Federal Aviation Administration (FAA) developed an SMS implementation guide to assist organizations in systematically developing SMSs. The purpose of the guide was to help organizations, particularly those involved in the FAA SMS pilot program, develop SMSs to FAA expectations and international standards (FAA, 2010).

Aviation organizations realize that threats to safety always exist (Adjekum, 2013). An SMS is designed to identify these threats and mitigate risk before accidents occur. Gill (2004) noted that “the effectiveness of a SMS depends on how

well it permeates in the fabric of the organization 'the ways in which things are done' so that a positive safety culture is generated and maintained in an ongoing manner" (p. 233).

The International Civil Aviation Organization (ICAO) (2013) states that having a reporting culture is key to developing a strong safety culture. A reporting culture involves cultivating an atmosphere where people within the organization feel comfortable reporting hazards without fear of reprisal. Dillman, Voges, and Robertson (2009) conducted a study to try to determine the perceptions of students regarding failures to report hazards. Dillman et al. (2009) suggested "a key ingredient to the success of any safety culture is the need for information about unsafe events, activities, or potentially hazardous operations" (p. 1). The reporting of hazards can help an organization with continuous improvement. The ICAO, (2013) states that "continuous improvement in safety performance is possible when safety becomes a value within an organization as well as a priority" (pp. 2–10). A goal of this study will be to attempt to identify what the other factors are within SMSs that enhance culture and increase the value of safety.

Measuring safety culture is a key aspect of SMS as well as continuous improvement. Safety culture is the synopsis of various safety behaviors and attitudes, and the term "safety culture" means different things to different individuals and can be challenging to accurately assess. There have been many studies that have assessed safety culture in all types of organizations (Gill, 2004; Freiwald, Lenz-Anderson, & Baker, 2013; Lee & Weitzel, 2005). However, few studies exist addressing the relationship between SMS implementation and its impact on developing a strong safety culture (McNeely, 2012). This qualitative study will focus on the safety professional's perceptions of the relationship between SMSs and safety culture in a collegiate flight training environment.

Background

A key aspect to the success of an SMS is the presence of a positive safety culture (Stolzer, Goglia, & Halford, 2011). The term "safety culture" has numerous definitions. In a recent study conducted by Adjekum et al. (2015), a two-pronged definition was used. This approach utilized a definition by Cooper (2000) as "a set of shared values, actions and behaviors that demonstrates a commitment to safety over competing goals and demands" (p.113). Another definition of safety culture by Piers, Montijn, and Balk (2009) indicated "the set of enduring values and attitudes regarding safety issues, which were shared by every member of every level of an organization" (p. 5).

The theoretical framework has been established that there is a relationship between SMSs and safety culture.

McNeely (2012) documented that two theories exist. The first theory is that SMS implementation leads to a strong safety culture. To validate this theory, Freiwald et al. (2013) conducted a study at a multinational multicampus flight training organization for the purpose of assessing the attitudes and perceptions of the operations and management staff. The results of the study concluded that the organization had a lack of safety culture and recommended the implementation of an SMS as a result. The second theory postulated that a strong safety culture caused SMS implementation (von Thaden & Gibbons, 2008). McNeely's (2012) study identifies that the basis for both of these theories has not been established empirically and continues to suggest that more research is recommended in the above-mentioned theories. McNeely (2012) stated that "organizations would benefit from understanding that the level of organizational safety culture and the level of SMS implementation relate, although the direction of the causality for this relationship is not definitive" (p. 115). Another recommendation for further research is suggested to measure the manner in which management's commitment to safety affects organizational safety culture development and SMS implementation.

Another study conducted in 2013 by Adjekum assessed safety culture at a collegiate four-year flight program. The purpose of the research was to assess perceptions of various groups within the organization and to establish a safety culture assessment methodology that could be replicated at other universities. The author recommended that more studies assessing safety culture be conducted at other flight programs. The results of these studies could be cross-validated to build a usable database and could help provide a baseline for the development, implementation, and continuous improvement of SMSs in collegiate aviation programs (Adjekum, 2013).

In 2015, Adjekum et al. conducted a cross-sectional quasi-mixed-methods assessment of safety culture perceptions and safety behavior in U.S. collegiate aviation programs. More specifically, the study's objective was to determine what safety culture variables predicted safety reporting behavior. The authors found that reporting systems and safety fundamental perceptions were predictors of safety reporting behavior. The results of the qualitative aspect of the study concluded that many pilots felt pressure to fly when conditions were considered unsafe. The participants of the study also thought that pressure was placed on them when they were not fit psychologically or physiologically to fly. Ultimately, the authors recommended that safety awareness and safety reporting programs extend to all involved in collegiate aviation programs. The study also concluded that safety culture assessments continue to be conducted. The authors noted that qualitative approaches can be effectively utilized to develop a better understanding of safety culture perceptions within collegiate aviation programs.

Research Questions

This qualitative study investigates the relationship between the elements and the processes of SMSs and their impact on safety culture. The primary objective of this research is to report the perceptions of safety professionals with regard to this relationship. The following research questions were addressed:

1. What were the experiences of safety professionals and the strategies that the flight training institutions took to develop and implement an SMS?
2. How do different flight training institutions approach the assessment of safety culture?
3. What elements and processes of an SMS contribute to a strong safety culture?

Methods

Procedures

The research paradigm chosen for this particular study was qualitative. Because it is qualitative, this study is not meant to be generalizable to a greater population. The purpose of the study was to investigate the experiences of safety professionals who have engaged in SMS development and implementation and their perceptions of how SMSs and safety culture are related. The insights gained from the safety professionals who were interviewed may be valuable information to other colleagues engaged in SMSs. The research tradition chosen for this particular study would be considered a phenomenology. According to Creswell (1998), a phenomenology's focus is to understand the essence of experiences about a phenomenon. Lichtman (2013) states that "Phenomenology, as an approach, looks at the lived experiences of those who have lived with or experienced a particular phenomenon" (p. 85). An organization's safety professionals are typically the individuals responsible for the development and implementation of SMSs. They are also the individuals typically responsible for overseeing the many elements and processes involved in running an SMS program, including the measurement of a safety culture. Their perceptions of the relationship between SMSs and safety culture could assist others with future SMS development and implementation.

Participants

The sampling technique used for this study was purposeful sampling. Patton (1990) states that the nature of qualitative inquiry focuses in depth on somewhat small sample sizes that are selected purposefully by the researcher. The researcher originally selected eight flight schools utilizing the safety officer contact list maintained by the University Aviation Association (UAA) safety committee.

The reason for the selection of eight schools was that they were known by the researcher to have been in the process of SMS development to varying degrees. Five of the eight schools responded and agreed to participate in the study and have varying size of flight training programs. The five safety professionals interviewed have a significant amount of experience with safety management in various aspects of the aviation industry. The researcher e-mailed the safety professionals selected from the list and asked if they would participate in the study with a 15–45 minute interview. The participants were also sent a form asking for their consent to record their interview.

Data Collection

The primary method of data collection was semistructured interviews with collegiate aviation safety professionals. Interviews are the primary method for collecting data when doing a phenomenological study (Creswell, 1998). From the semistructured interview, the author gained the information to describe the perceptions regarding SMS development and implementation as well as the relationship between SMS elements and safety culture. To facilitate the interview, the author utilized a self-developed interview protocol. Before the semistructured interviews began, a colleague considered to be a subject matter expert in SMSs reviewed the interview protocol to ensure its appropriateness. The interview questions were designed to engage the participants in conversation that would lead to discussions regarding the subject matter within the research questions. After interviews were completed, the author transcribed each conversation for coding to assist in identifying common themes. The interview transcriptions and recordings were cross-checked by a colleague of the researcher to ensure trustworthiness.

Coding is essential to qualitative research. Some researchers often consider coding to be synonymous with analysis (Hedlund-de Witt, 2013). The coding method employed was a combination between in vivo coding and descriptive coding. Hedlund-de Witt (2013) describes descriptive coding as a "straightforward coding method used to assign basic, descriptive labels to data to provide an inventory of their topics" (p. 10). This is often the first step in the coding process. Since the goal of the study is focusing on the perceptions of the safety professionals, the author thought it important to express those perceptions with direct quotes from the participants. In vivo coding is a method whereby a code is taken verbatim from the interview and placed in the analysis inside quotation marks (Hedlund-de Witt, 2013). Therefore, in vivo coding seems appropriate for this study.

Researcher Positionality

Positionality in any qualitative research study is worthy of noting and understanding how it may affect the research.

The author's position considered for this particular study is to be a significant factor and one that should be recognized. The author has served as the safety officer for the Aviation Department at Southern Illinois University (SIU) since 2007. In this role, the author developed and implemented an SMS program for the Aviation Management and Flight Department at SIU over the last four years. The author believes that an SMS program strengthens a safety culture, and he has ideas and perceptions as to what processes and elements enhance and strengthen a safety culture in an organization. He also recognizes that his experience is based on one organization. This experience has led him to be interested in the perceptions of others and gain a better understanding of the relationship between SMSs and safety culture.

Limitations

There were a couple of limitations concerning the type of sampling utilized and the sample size. Using a purposeful sample from the UAA network and a small sample size of safety professionals limits the study to just their experiences. While useful, others outside of this group may have other experiences concerning SMSs and safety culture that could benefit colleagues in the flight training environment.

Results and Discussion

During the interviews, basic descriptive data was gathered from the participants. To determine the approximate size of the institution represented by each safety professional interviewed, see the data in Table 1.

SMS Development and Implementation

One of the goals of the research was to gain insight into the experiences of safety professionals and how flight training organizations have developed and implemented SMSs or are in the process of SMS development. The first research question asked "What were the experiences of safety professionals and the approach that the flight training organizations took to develop and implement a Safety Management System?" The majority of organizations gauged their SMS progress in a series of steps. A safety professional (SP) from Institution 1 stated, "We were told to expect about one year per level; if you could do it faster, then you may be taking shortcuts. People only move so fast; cultures only change so fast." The SP in this case was referring to the levels established by the FAA. Only Insti-

tution 3 chose to take two years to write its SMS and then implement the SMS all at once. The SP for this organization mentioned that this choice has worked well for them.

Many organizations do not have the resources to implement an SMS all at once. Institution 2 is an example, for it is a smaller organization and has established an SMS over time, and the SP believes that they are about 50–60% complete. The SP from Institution 4 reported that "jumping in and trying it all at once would be too big for us to swallow. It's up to me to do it, so we are just going to have to do it in steps." Institution 5 also has many of the elements of an SMS, including hazard reporting, a safety committee, and supplies feedback to an individual submitting a report. They have experienced a change of leadership, and the continuous development of an SMS has become a challenge.

Overall, the general consensus among the participants was that an SMS works best if it is implemented over time. The SP from Institution 5 commented, "It [the SMS] takes a long-term commitment that never stops." Even Institution 3, an institution that implemented its SMS all at once, still planned its SMS for a couple of years prior to implementation.

Safety Culture and Assessment

The second research question asked "How do different flight training institutions approach the assessment of safety culture?" Each safety professional was also asked about his or her assessment of safety culture, including how they assessed culture in the past as well as currently and what kind of changes they have seen in safety culture as they have developed and implemented SMSs. All of the institutions have methods to assess safety culture within their organization except for Institution 2. The SP from Institution 2 understands the need to develop a method to assess safety culture within the organization and will probably implement something in the coming year. Institution 4 has conducted safety culture assessments in the past, but they were not a formalized process.

Frequencies regarding the assessment of culture varied among the group. Table 2 identifies the variation among the flight training institutions.

In general, all SPs from each organization, including Institution 2, believed that they had a strong safety culture, although they all mentioned that there were areas for improvement. For example, the SP from Institution 5 stated that "Our overall safety culture is fairly positive,

Table 1
Size of Flight Training Institutions.

	Institution 1	Institution 2	Institution 3	Institution 4	Institution 5
Aircraft	120	18	65	8	15
Students	1,500	40	1,300	100	90
CFIs	175	4	150	10	15

Table 2
Frequency of Safety Culture Assessment.

Institution 1	Institution 2	Institution 3	Institution 4	Institution 5
Biannually	N/A	Annually	Not formalized Plans on quarterly	Annually

so is the operation safe? Those kind of questions came back positive. But, as for the feedback loop, that seemed opaque. They would fill out on the survey that they [individuals in the organization] don't see the benefits of the SMS."

Institution 1 did not assess safety culture prior to SMS implementation. The SP stated that "Someone would come up with questions here and there but would never go back to reanalyze it; trends were never looked at." He went on to say that "Yes, we started assessing safety culture four years ago. Formally we sat down as a committee and decided how many questions would be asked and what they would be [for the safety culture survey]. The process took six months of committee work prior to that." The SP noticed a culture change when the accountable executive and process owners started to "drink the SMS Kool-Aid." Safety became everyone's program because of the safety culture questions and the visibility that the survey was receiving.

Institution 3 started working on safety culture assessment four years prior to SMS implementation. The SP recognized that a reporting culture is a major part of safety culture and stated that "we always knew the importance of a reporting culture but never had a formal ASAP [Aviation Safety Action Program] until two years ago. . . . [R]eporting has been vibrant since 2002." In terms of any change in safety culture as a result of SMS, the SP stated:

If we didn't have the foundation of the current design of SMS, our culture might have tapered off because we have been through some leadership changes. Because of the way SMS is written, it formalized the concept of accountable executive, so some of the leadership changes were dramatic at the flight department level but not at [the] presidential level. If culture started to taper, [the] SMS mandated some requirements so the culture could not go too far out of whack. . . . Had strong culture before SMS but now, . . . now with SMS and formalized components and the advent of ASAP we have seen strength in our reporting culture because now they know they are protected. SMS has made a strong indent in enhancing and sustaining the safety culture that we want.

Without having a formal safety culture assessment, Institution 2 had an overall positive impression of its safety culture. The SP stated that "We went from the total idea of 'I'm not going to report anything' to at least some voluntary ideas and suggestions along with some incident

reporting." The SP also mentioned that the nonpunitive aspect of hazard reporting has had a positive influence on Institution 2's safety culture.

Institution 4 had been doing some informal assessments prior to SMS but was not necessarily tracking trends. The SP thought that, overall, the safety culture was strong: "The students seem to be responding positively to it, I get a lot of feedback and questions from the students . . . as well as from the instructors [regarding SMS]." He also mentioned that there was a significant increase in reporting.

Other methods for assessing culture that were used consisted of observations, including Line Oriented Safety Assessments (LOSAs) and reporting frequency. Institution 3 and Institution 1 both firmly believe that reporting frequency is a key component of assessing safety culture. Institution 3 measures its reporting frequency with flight hours.

SMS Elements and Processes

The third research question asked "What elements and processes of a Safety Management System contribute to a strong safety culture?" The four components—safety policy, safety risk management, safety assurance, and safety promotion—have many elements and processes within them that make the system work. All participants mentioned that it takes all of the components to build a culture. The SP from Institution 1 stated that "You really know you have the culture if, you can see a need, see a hazard, see a risk. [Y]ou do some risk mitigation and go to component one to establish new policy, and you get rid of old policy, promote and train it in component four . . . [and] then go back and reassess through assurance to see that it is doing what you think it is doing." However, more specifically, having a confidential hazard reporting system is key to developing a strong culture, which was a common theme from all of the SPs. One SP stated that "Reporting is the most important. It does not matter the size that you are."

Component two, safety risk management, was highlighted through a few of the conversations as being extremely important to building a strong safety culture, specifically the utilization of the safety risk management five-step process. Training and education was also mentioned, with the SP from Institution 4 saying "convincing everyone that a SMS is beneficial to them through training and education." Another SP agreed: "Education and training is essential." The SP from Institution 5 summed up the most important elements and processes, which

included organizational commitment, nonpunitive reporting, communication, and safety assurance processes.

At the end of the conversation, all participants were asked their thoughts regarding the two theories documented by McNeely (2012). All of the SPs identified with the theory that a strong safety culture builds an SMS, rather than the opposite. One very experienced SP even stated that “I’ve never seen any systemic changes to culture by the presentation of a manual.”

Conclusions

This study sought to investigate the perception of safety professionals within flight training organizations with regard to SMS and safety culture. Of the five participating institutions, only two had a fully deployed SMS. The other three had been working on it for a few years and had many of the elements and processes in place. No matter the level, all but one found it useful to implement in steps generally coinciding with the FAA’s methodology of levels. All of the SPs reported their belief that they had a strong safety culture. However, one institution reported not having a formally assessed safety culture. There are many ways to assess safety culture. The most common form is through a survey instrument. A survey instrument can be useful and give both quantitative and qualitative data. Only two of the institutions utilized other methods, such as LOSAs, flight data management, audits, and observations.

The SPs all had different perceptions regarding the most important elements and processes within the SMS structure that helped build a strong safety culture. A confidential hazard reporting system was viewed as the most important aspect to help build a strong safety culture. Other elements that had a strong relationship to safety culture that received attention from multiple SPs were education, training, and the SRM five-step process. During the development and implementation of SMSs, the multiple SPs identified a couple of instances when they experienced culture change. The first occurrence was when they had a commitment from the accountable executive, and the second was when the stakeholders in the organization realized the benefits of SMSs through changes being made from hazard reporting and safety culture assessments.

Recommendations

Building a safety culture and an SMS takes time and is a never-ending process. It is interesting that all the SPs identified a time when they witnessed a safety culture change during the SMS development but also had an overwhelming feeling that it is a strong safety culture that builds an SMS. The reality based on the safety professional’s perceptions is that it is a circular relationship. The author recommends that future studies, both qualitative and quantitative, continue to focus on this relationship between

SMSs and safety culture. Future studies could also focus on safety behavior indicators and targets and how those might be used to establish a quantitative study to parallel a qualitative study similar to this one.

Hazard reporting was discussed in great length with every SP. One SP commented that he would like to see more research when comparing the relationship between quantity of hazard reports and safety culture. The author agrees that more research could be done in this area, including future qualitative studies that could also investigate reasons for nonreporting as well as the relationship between the reporting process and safety culture.

The participants of the study agree that when an organization engages in the development and implementation of an SMS, it can seem like an overwhelming process. The participants were asked to provide recommendations to those who have not started or are just in the beginning stages of developing an SMS. Some common themes from the participants are listed below:

- Take your time. Utilize the FAA’s methodology for developing SMS.
- Realize that it is an ongoing and a long-term commitment.
- Involve all the stakeholders, from the students and staff all the way to the accountable executive.
- Establish a reporting system (web-based if possible).
- Reporting process needs to include feedback to the reporter.
- Assess safety culture from the beginning of the development process and on a continual basis that works for your organization.
- Develop a safety committee and meet and discuss progress on a regular basis.

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