A Review concerning safety culture and inherent communication dimensions in air navigation services

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Abstract
This paper resumes a literature review about safety culture as a sub dimension of organizational culture whilst exploring the straight link with organizational internal communication.

The safety culture concept was introduced in final 80’s when the results of the investigation on the Chernobyl accident became a milestone due to the initial consideration of organizational factors in the accident causality chain. Since then, safety culture raised as an important dimension of organizational culture to be developed in a positive way in High Reliability Organizations (HRO) such as Air Navigation Services Providers (ANSP).

The common key element linking all components of a positive safety culture is indeed the organizational internal communication which plays an essential role fostering relationships either between employees or establishing a link with management. It grants general information about safety politics, programs and essential guidelines to be implemented. It’s scope of influence reach safety reporting, human factors, training and shiftwork routines. Moreover, all safety related information e.g. feedback from safety analysis, need appropriate communication links supported by an effective safety management system.

Keywords: safety culture, internal communication, air navigation services
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1. Introduction

Air traffic congestion became a problematic issue in the European skies since the 90 decade due to an increasingly inefficient air traffic management as a consequence of an overly fragmented airspace. To overcome this problem a “Single European Sky” initiative was launched in 1999 by the European Commission bringing a new paradigm and setting a new scene based on the defragmentation of the European airspace.
With the actual globalization demanding both cost efficiency and competitiveness in the short term, the launch of the “Single Sky” project tries to fulfill this aim and is entering now on its deployment phase. The main objectives of such an initiative include a three-fold increase in capacity, reduction of environmental impact in 10% and cutting in half air traffic management costs, as well as increasing safety by a factor of ten (SESAR JU, 2014).

Thereby, during the last years it was required a hard investment from European Air Navigation Service Providers (ANSP) in their technical system’s interoperability to cope with increasing traffic demands which draw additional attention to safety culture. To that purpose, it became mandatory the implementation of Safety Management Systems in all European ANSP’s.

Like in other High Reliability Organizations (HRO) such as nuclear power plants, oil platforms or chemical industry, safety culture is considered a main concern by Air Navigation Service Providers, in order to guarantee a high level of safety in the operational performance. Aligning with this objective, internal communication aids effectiveness by linking all the organizational relationships and as a mean of conveying politics, objectives, programs, rules and procedures.

Although literature has little reference both to the air navigation safety culture and the related internal communication perspective, there are some concepts like “just culture” that protrude in the aviation domain. Although safety concerns in this domain involve other operational staff, research studies focuses mainly in the air traffic controller function or cockpit environment.

Knowing that High Reliability Organizations such as ANSP’s must develop their work in a continuous mode of operation, facing complexity and risk, that enlightens the human capital representing the productive potential of the knowledge and actions of an individual (Kinicki & Kreitner, 2006) as the system element that assure safety in daily routines. The fact that all operational staff working at the sharp end of the system deal with hazards and inherent risks in a daily basis emphasizes the importance of human factors in the air navigation services scene. Therefore, the researchers interest in human factors drifts from the need of knowledge to prevent human error and improve risk control.

The organizational internal communication is a crucial link for the development of internal activities and functions that endure a proper safety culture. Undoubtedly, the relationship between operational staff and with the management hierarchy, compose a multiple channel influence facing various dimensions of safety culture which is advantageous exploring.

Thus, the influence of internal communication manifests itself in various determinants of operating performance, including human factors which are circumstantially important in the
shift working environment. The relevance of various disturbing factors management like excessive levels of stress and fatigue by shift supervisors, as well as team communication and safety training is recognized as a critical key factor for safety performance.

Moreover, the communication with management is another determinant of a desirable positive safety culture that reflects the organizational commitment to safety.

Accordingly, the purpose of this study is to introduce a new viewpoint concerning the organizational internal communication influence in air navigation services safety culture. After a brief reference to some organizational culture concepts to better understand the safety culture framework, we proceed recalling the conceptualization and genesis of safety culture and its main determinants. In that sense, some considerations about management commitment, the just culture principle as part of a positive culture, risk management and human factors issues are presented. The communication role linking all previous safety culture determinants concludes the review.

The main discovery derived from this study is the acknowledgement of internal communication as the centerpiece of an ANSP safety culture and the identification of the most influenced safety-related dimensions. Given its practical implications to safety critical organizations, enhancing and investing in a communication strategy is worthwhile to ensure a strong and positive safety culture. This has remarkable impact on risk management and disclosure of safety politics, programs and critical information.

Furthermore, knowing the huge influence that perceived organizational commitment to safety has on the operational staff engagement, all levels of management must wisely use internal communication as a privileged platform to support safety in the organization.

2. Organizational culture baseline

According to many researchers, organizational culture is composed by norms values and beliefs, typical of each organization in a way that distinguishes it from any other. As Camara, Guerra, & Rodrigues (2007) enhance, understanding an organization’s efficiency demands an intrinsic analysis of its culture.

Literature has plenty of perspectives: Schein considered culture composed by a set of basic assumptions in which individuals base their attitude and perceptions of the organizational reality. Sainsaulieu found cultural differences between different activity sectors and professional groups. Hofstede, recognized the holistic nature and difficulty in changing culture eventhough there remains some lack of consensus in setting a definition.
The several definitions of culture pointed by literature evolved from considering a shared meaning system (Pidgeon N., 1991), to shared values and beliefs, common problem solving and way of work (Hudson, 2000), or the metaphorical reference to a collective programming of the mind (Hofstede, 2003).

Nevertheless, the proposal of Schein (2004), has been the most accepted and detailed one, establishing a shared model of basic assumptions captured by the group while adapting themselves to the external environment and related problems. Once the validity of these assumptions have been proved, they may be forwarded to new members as an adequate mean of understanding, feeling and thinking about such problems.

By another perspective, literature presents the concept of organizational climate which appears often paired with the concept of organizational culture and standing close to it (Denison, 1996) in such a way that rise the doubt if both could not be the same concept after all (Glick, 1985; Guldenmund F., 2010). On the contrary, other researchers like Glick (1985) sustain that there is a methodological divergence based on different disciplinary origin and mensuration methodology. In this sense, some authors (Bancaleiro, 2001; Guldenmund F. W., 2000; Ferreira, et al., 2011; Verbeke, Volgering, & Hessels, 1998), consider both concepts completely distinct, while others endorse their complementarity (Chambel & Curral, 2008; Neves, 2011).

Among the several definitions and considerations exhibited about organizational culture it can be seen as a set of basic assumptions as a basis for individuals to make their perception about organizational reality and develop their attitude (Schein, 1990; Schein, 2004), or be able to identify divergences when analysing different activity areas or professional groups. Like Hofstede (2003) most authors agree with the lack of an exact definition but are consensual in characterizing organizational culture as an holistic concept which is hard to change but reflects the organization’s history.

With its roots relying on Anthropology and inheriting from there multiple definitions and lack of consensus, the greatest difficulty in defining organizational culture comes from the different basic assumptions that researchers make about “organization” and “culture” (Smircich, 1983).

One prominent sub dimension of organizational culture in High Risk Organizations (HRO) is safety culture, which conveys an important approach to deal with risk in technological complex environments like air navigation services. Its importance stems from assuming the core focus emphasized in the organizational culture of such organizations as detailed ahead.
3. Safety culture

There is an inherent singularity in air transportation that differentiates it from other means of transportation and demand specific requirements to the related services. That singularity arises from the fact that, once in movement, the time for air traffic to evolve is restricted and must terminate with a landing. Additionally, it has also more international considerations that any other means of transportation (ICAO Doc 9624-AN/924, 1984).

Currently, air navigation services are facing remarkable changes and a paradigm shift at the global European level due to the “Single Sky” project. Defragmenting European airspace by means of setting Functional Airspace Blocks (FAB’s) is just one of the deployments to expedite air traffic flow and fix the severe congestion issues that affected European skies in late 90’s.

Multiple considerations about increasing safety in the aviation domain are under the scope of this project to fulfill one of its main objectives. This requires focusing on the developing of all ANSP’s safety culture.

The systemic approach of safety culture in air navigation services drifted from similar approaches in other high risk industries e.g. nuclear, chemical, oil platforms, and succeeding the so called “man-made disasters”. Some of the most severe organizational accidents took place in the eighties like the nuclear accidents of Three Mile Island (1979) and Chernobyl (1986), the chemical leakage in Bophal-Índia (1984), the explosion of shuttles Challenger (1986) and Columbia (2003) or Exxon-Valdez oil spill in Alaska (1989). Such accidents arise the need to explore organizational latent causes that could bring forth active failures.

Heading our attention to this so-called High Reliability Organizations (e.g. nuclear power plants, oil platforms, chemical industry or aviation) working in complex and high-risk environments, we can identify an emerging subdimension of organizational culture that emphasizes safety concerns. This relates to safety culture itself.

Imbedded in organizational culture, the safety culture promotes a proactive approach in order to manage and control risks willing to avoid accidents or any kind of serious incidents.

After reviewing some literature, it becomes obvious the lack of agreement in defining either safety culture (Cox & Cheyne, 2000; Pidgeon N. , 1991), or its principal components (Frazier, Ludwig, Whitaker, & Roberts, 2013). Nevertheless several models have been developed (Cooper, 2000; Reason, 1998; Westrum, 2004), as well as some literature reviews (Guldenmund F. W., 2000; Glendon & Stanton, 2000; Wiegmann, Zhang, von Thaden, Sharma,
& Gibbons, 2004; Mearns & Flin, 1999; Chouldry, Fang, & Mohamed, 2007; Gadd & Collins, 2002) concerning the theme.

Although safety culture has been capturing researchers' interest since the 80's with several definitions being formulated, it was still "ill defined" after two decades (Guldenmund F. W., 2000). Even some research articles stated such ambiguity in their titles (Safety culture: philosophers stone or man of straw?, 1998; Culture’s Confusions, 2000).

The main objective of a safety culture is to prevent accidents. Seeking that purpose four key determinants are considered to resume and promote a "good" safety culture: (i) senior management commitment and support, (ii) a positive safety culture, (iii) risk management, and (iv) safety management system (Pidgeon & O’Leary, 1994; Pidgeon & O'Leary, 2000). These determinants are closely related and depend upon a good communication to accomplish their main objectives.

The expression “safety culture” appeared for the first time in the investigation report about the Chernobyl nuclear accident in 1986 (Pidgeon N., 1991; Cox & Flin, 1998; Zhang, Wiegmann, von Thaden, Sharma, & Mitchell, 2002), enlightening a new accident causality perspective, that considered organizational causes for the first time in the chain of events that could lead to an accident.

In what concerns aviation, a few examples of organizational factors contributing to accidents can be found in investigation reports, such as the ones identified during Überlingen and Linate investigations (BFU, 2004; ANSV, 2004).

Safety culture’s main objective of preventing accident and incident occurrences can only be achieved with a proper risk management to identify hazards and mitigates risks. Otherwise adverse consequences derived from fatal events will have huge organizational and social impact.

In another perspective, safety culture is closely attached to staff attitudes and their perceptions of self-exposed risk magnitude (Booth & Lee, 1995). Moreover, safety culture is not only composed by individual attitudes but reports to groups of various dimensions involving organization’s norms and behaviors. It reflects the way safety is managed in the workplace, as well as the attitudes, beliefs, perceptions and values that employees share in relation to safety (Cox & Cox, 1991). With direct impact in performance it gives a comprehensive and clear organizational risk picture. Referring to air navigation it represents the priority given to safety at all organizational levels that reflects the real commitment towards it (EUROCONTROL, 2012).
3.1 Management commitment

The management commitment to safety is crucial to assure the organizational prioritization of safety without compromising it at the expense of economic and productive interests.

The management commitment, as well as operational staff involvement are widely referred in literature as influent factors to a positive safety culture (Cox & Cheyne, 2000; Mearns, Whitaker, & Flin, 2003; Fernández-Muñiz, Montes-Péon, & Vásquez-Ordás, 2007).

All hierarchical chain, specially the intermediate leaders that are seen by Schein (2004) as culture management supporters, must take actions and initiatives in order to promote safety development e.g. safety training, safety program.

In terms of communication they have an important role in transmitting the organizational politics, strategies and safety objectives. Moreover, it’s their responsibility to nurture a positive safety culture, promote an atmosphere of trust in a so called “just culture” scenario were gross negligence or intentional violation of rules and procedures must be punished but unintentional errors or omissions that are reported are used for learning purposes and to mitigate future risks.

The establishment of an atmosphere of trust between management and employees is essential to support a just culture that surely incentivizes voluntary incident reporting in the context of a safety management system.

3.2 Developing a positive culture

In general aviation, high reliability industries and air navigation services, where safety is a critical centerpiece, a positive safety culture is known to be a just culture, providing orientation and guidelines (Woods, Dekker, Cook, Johannsen, & Sarter, 2010). In line with Reason’s (1998; 2009) thinking, this is seen as an approach to foster learning from failure without relinquish accountability. Just culture is therefore considered an important matter in industries exposed to risk and complexity.

The development of a positive culture requires a collective commitment to safety as well as identical and positive perceptions and attitudes. Thus, an effective communication is mandatory (EUROCONTROL/FAA, 2008).
In Reason’s (1998) opinion, a strong safety culture is featured as just, reporting, flexible, informed and learning. The importance of a just culture had been growing for the past years as a key factor to enhance and promote safety in HRO’s.

Implementing a just culture allows to learn lessons from the reported non-intentional errors or omissions disregarding a blame intention but assuring accountability. This enables frontline operators and others in the system not to be blamed for actions, omissions or decisions in accordance to experience and training but where gross negligence or intentional violations are not tolerated (EUROCONTROL, 2006).

This approach has proved to be more effective to risk management than blame or punishment cultures, as the organization benefits from an increment in voluntary incident reporting once provided that is fostered by a trust atmosphere built between management and staff. Additionally, it has been proved that promoting a more effective safety management increases trust in frontline operators when they perceive management commitment to safety stays above interest in assigning blame. (GAIN Working Group E, 2004).

To assure the wide implementation of this concept in European ANSP’s, the European Parliament ruled about the mandatory consideration of just culture in the safety investigation framework (Regulation (UE) Nº 996/2010, 2010), to withdraw the blame intention and actually focus on accident and incident prevention.

Implementing this concept demands the definition and accordance about the position of a separation line between acceptable and unacceptable actions. Since learning from insecure acts is one of the main benefits of just culture (EUROCONTROL, 2006), it requires the promotion of critical event reporting to analyze the causes of safety-critical events. This features a positive culture as reporting and learning. Being another characteristic of a positive culture its flexibility in allowing adaptation in critical and emergency situations by means of quick and smooth adjustments to out of routine modes of operation, the sum of all previous characteristics converge into an informed culture.

### 3.3 Risk management

In aviation, risk is defined as the likelihood of an unwanted outcome, which is most of the time associated with an element of human error (Patankar & Taylor, 2004). Nevertheless, when human error occurs, some predictable patterns can be identified and therefore mitigation measures can be applied (Wells & Rodrigues, 1991). In such environments involving a high
degree of risk, the human error must be properly mitigated as any accident consequences have great organizational and societal impact.

In the air navigation services domain the major objective of safety is the identification and control of hazards that can compound risks to the activity. That is achieved by granting that the risk of harm people or damage property is reduced to and maintained at, or below, an acceptable level through a continuing process of hazard identification and risk management (ICAO, 2009).

To accomplish this objective it is necessary to constantly measure, assess and provide feedback to the system (Stolzer, Halford, & Goglia, 2008). To achieve this purpose a safety management system is put in place to gather safety relevant information from voluntary incident reporting systems, crucial to human factors management and error prevention.

The obvious importance of internal communication evidence its impact in this communication flow as well as in the shift working context were the supervision of teams and all teamwork coordination and communication play an important role.

Learning from insecure acts demands an effective report system to be in place and the willing from operational staff to report hazardous or critical events. Thereafter, the communication of good practice and safety recommendations following investigations as well as any other safety relevant information contributes to a better preparation and higher levels of safety performance. This features a good safety culture as an informed and learning one.

Determining the level of risk to which the organization is exposed demands a proper hazard identification as well as risk assessment and management. This will accomplish the need to break the causality chain of critical events in order to identify latent or active failures and ensure adequate safety levels (Booth & Lee, 1995). With this goal in sight, the International Civil Aviation Organization (ICAO) establishes on the Annex 11 to the Convention on International Civil Aviation (ICAO, 2001) that all ANSPs shall develop and maintain a formal process for risk assessment and control.

3.4 Human factors impact

Without an exact definition, human factors are broadly described as the factors related to human in the system (Drury, 1996), taking in account the interaction between people and the system composed by other people, equipment and procedures (Hawkins, 1987).
Considering the unavoidable impact of human factors in organizations dealing continuously with technological complexity, uncertainty and risk, a careful hazard identification and risk assessment and mitigation should shrink the critical event causality chain and constrain human error probability. In accordance, Wells & Rodrigues (1991) remind us that considering the systematic and predictable patterns of human error, the recognition of those patterns allows the development of mitigation measures.

This is especially critical in High Reliability Organizations or High Risk Organizations (HRO), were work must be uninterrupted and therefore shiftwork is implemented, in a technological complex and exposed to risk environment.

Human factors capture much of air traffic control researcher’s interest (Finkelman & Kirschener, 1980; Weikert & Johansson, 1999) intending to expand knowledge about the impact of several pressure factors in shiftwork environment. Disturbance factors such as fatigue, stress and workload, impact adversely in human performance, particularly during night shifts and shall be well managed once it’s known the existence of recurrent patterns for adverse events (Reason, 1998).

Since the human contribution to the system is the focus of the human factors study, some problematic is introduced by communication issues. Several studies identify the communication in shiftwork context as critical, especially during transference of information between shifts. As underlined by Flin, O’Connor, & Crichton (2008) communication issues in shift transition can constitute a major barrier to service continuity. Therefore the communication dimension plays a key role in safety culture.

4. The role of internal communication

All organizational activities and relationships between human resources require a fundamental role played by internal communication. The need of an effective communication begins with the socialization process that acculturates all employees with the established culture.

All dimensions previously identified as significant to safety culture e.g. management commitment, human factors, risk management, strongly depend on an effective internal communication. This feature is especially critical when dealing with human factors. Shiftwork brings various disturbing and pressure factors like workload, fatigue, stress and even boredom
during late night hours, that can be hazardous and allegedly leverage human error. Likewise, the circadian rhythm is affected during night shifts work, inducing fatigue.

Bowditch & Buono (1997) define communication as an information exchange between a sender and a receiver, evolving the perception of meaning between the participants. In another perspective Bland & Jackson (1992) distinguished two categories: operational information relative to organizational action and informative communication gathering all matters that people need or intend to know.

Due to safety matters in high reliability industries, communication effectiveness is a key factor in the context of risk management, safety assessment and assurance. As remarked previously by Flin, O’Connor & Crichton (2008) one of the greatest barriers to service continuity with impact in operational performance and safety levels is the shift transition failure due to poor communication between shifts. Therefore, the critical communication role in shiftwork scene applies to human factors issues with impact on shift relationships concerning supervision and teamwork.

In fact, communication is essential for organizations regular work as a mean of conveying tasks, norms and procedures and to inform about organizational plans, programs, politics and strategies. As previously remarked, beyond featuring this executive instrumental nature, it plays another important role giving support to organizational member’s integration throughout the socialization process.

5. Conclusions and future research

Upon reviewing the literature both in safety and communication domains, there is an easy recognition of a sub dimension of organizational culture that concerns to safety either as natural implicit links to communication.

The obvious link between internal communication and safety culture main dimensions is evidenced in vertical flows between management and operational staff, in supervision and teamwork, technical and safety training. Likewise, it concerns to all safety-related information like incident reporting and diffusion of safety assessments or investigation recommendations and good practices. Though, strengthening the organizational safety culture depends on an effective internal communication following the expected management commitment to safety, risk and human factors management.
Accident prevention is the main objective of a safety culture. Therefore, concerning risk management and in sight with the promotion of a positive culture, the reporting process is crucial to enable the organization to learn from failure extracting lessons and disseminating conclusions and recommendations.

The willingness to report is encouraged when an atmosphere of trust exists between management and operational employees. Moreover, the perceived organizational priority given to safety impacts on staff behavior. Several researchers stand up for the importance of senior management commitment with safety as a key factor for strengthening safety culture and climate. This enhances the significance of the vertical communication flow.

We must conclude therefore that there is an intrinsic relation and influence between an effective internal communication and the safety culture in air navigation services. The key role in sustaining all this dynamics is played from the initial establishment of objectives, plans, strategies and politics upon the relationships involving operational staff and feedback about operational performance.

Aiming to expand knowledge in this field, one suggested line for future research could be exploring the real impact of communication in safety culture main determinants. This could be achieved applying either a quantitative or dual (quantitative and qualitative) approach. The adoption of a single or multiple Case Study seems to be a good methodological option allowing in the last case to carry out a comparative study.

References


