Tips for Creating a Safety Culture in Organizations

ESTABLISHING, SUPPORTING, COMMUNICATING, AND IMPLEMENTING CLEAR SAFETY POLICIES WILL ALWAYS BENEFIT ANY ORGANIZATION.

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We live in a world filled with complexity and errors. Echoing the title of a book by Gene Kranz (2000), and as we reflect on the wake of recent tragedies, "Failure is not an option." The need to develop a safety culture in technology-advanced environments is crucial to an organization's success. In this article, we present tips to help organizations take a macro-level approach to safety through establishing a safety culture surrounding the implementation and use of new technology.

Technology and Human Error

Consider the following examples . . .

An employee at a manufacturing company is monitoring a new robotic system that carries sheet metal from one workstation to the next, when the system jams and stops. The employee has the choice to either turn off the system, which can take several minutes to power off and then back on, or enter the robot's work area and free the clogged system while the machine is still operational. What does he do – risk losing at least 10 minutes waiting to power back up or clear the jam in the system while it's still on? After all, he'll be able to move out of the way before the robotic arm moves back in his direction. As he's done at least a dozen times before without incident, the employee enters the work area without powering down the system. As he clears the jam, the robotic arm knocks him to the ground, fracturing his arm.

Or consider the "macho" aviator with thousands of flight hours, attempting to land in dense fog. As he approaches the minimum descent altitude for making a missed approach, he knows (well, he thinks he knows) that the aircraft will break out of the fog layer any minute, the runway will be visible, and he'll make a perfect landing, upholding the company's motto to "get passengers to their destinations safely and on time." The copilot has seen him do this numerous times and agrees that the runway will be in sight any minute. Within the next minute the aircraft does break out of the fog layer, but the pilots have misjudged the approach and are slightly off course. The pilot spools up the engines, making a missed approach and barely missing a building near the airport.

These examples are hypothetical, but some argue that the implementation of technology, such as robots in the manufacturing industry, may be advancing too quickly for operators to keep up (e.g., Jiang & Gainer, 1987). The literature is filled with evidence that human error in technology-driven environments such as manufacturing and aviation contributes to accidents and incidents more than two-thirds of the time (e.g., Decker, 2001; Helmreich, in press). If the manufacturing employee in the earlier example had turned the system off prior to entering the work area, the incident would have been prevented. But he didn't, as is the case when employees are faced with similar situations (e.g., Järvinen & Karwowski, 1995).

In an effort to protect humans and minimize the risk of errors, laws, regulations, and governing agencies have been developed (e.g., Federal Aviation Administration regulations, Occupational Safety and Health Administration guidelines). However, despite these safety laws and regulations, a significant number of accidents and incidents continue to occur each year. For example, OSHA estimated that in 2002, approximately 4.7 million worker-related injuries/illnesses (Bureau of Labor Statistics, 2003a) and 5500 deaths occurred in private-sector firms (Bureau of Labor Statistics, 2003b). Using the low-end estimation of the percentage of those accidents that are attributable to human error (60%), it can be estimated that 2.82 million injuries and 3300 deaths are the result of human error. These figures are astonishing.

So how are organizations addressing this issue? Many have turned to training employees to manage errors before they become detrimental (e.g., resource management training; see Salas, Bowers, & Edens, 2001). These organizations believe that by addressing the micro levels of the organization (e.g., providing minimal training to workers), human error will be reduced and safety improved. We argue that there is more than meets the eye when it comes to safety and that training alone may not be enough.

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As the complexity of new technologies increases, we believe that organizations must address safety at higher levels – that is, institute a "safety culture" – to ensure that technology is implemented and used properly. This is not to say that training for safety is not important; safety training is still necessary and should be incorporated into this safety culture.

10 Tips for Developing a Safety Culture in Organizations

In preparing this article, we drew on the available literature to determine which factors must be considered when developing a positive safety culture. Admittedly, there will always be the risk of error when human operators are involved ("to err is human"), but organizations can take steps to reduce dangerous, sometimes lethal incidents involving technology. From the literature we developed 10 tips that organizations can use now to help minimize future errors caused by technology overload, mistrust, or simple human error when interacting with complex systems.

These suggestions are meant to encourage organizations to approach safety from a macrolevel perspective that involves the entire organization and not just individual workers. We need to point out, however, that this is not an attempt to oversimplify the complexities inherent in the development of a safety culture. It is likely not as easy as it looks. We hope that what we present here will provide organizations with a starting point from which to build. We recommend that organizations take great care when incorporating these tips into current practices and examine their meaning at a deeper level.

Additionally, although some of the information presented next may seem like old news, through the literature and our experiences, we have found that research findings are not being implemented in the real world. Initially, the cost and time that an organization must spend to implement a safety culture is great and may deter some, but the outcome – improved safety – will far outweigh the investment.

We also noted the absence of a synthesis of the literature that could offer a complete picture of the macro- and microlevel factors that must be considered when implementing technology into an organization to ensure safety. Therefore, we present the tips along with findings in the literature to support them in a summary table (next page).

Tip 1. Send appropriate signals that safety matters . . . clearly and precisely communicate them. It is not enough to say that safety is important. Organizational leaders must promote it through their actions and by putting it in writing. Underlying an effective safety culture are documented safety policies and procedures. Safety policies set by managers provide employees with a broad description of what is expected in terms of safe attitudes and behaviors, and procedures provide employees with guidance on how to meet those expectations (Degani & Wiener, 1997).

Research by Diaz and Cabrera (1997) suggested that safety policies likely influence workers' behaviors, their perceptions, and the overall safety climate. We argue that in order to ensure that safety policies and procedures are adhered to, organizations must do two things. First, they must *get employees involved* (e.g., participatory ergonomics) to ensure that workers will accept the implementation of new technologies. Research suggests that involving employees throughout the development and implementation process of the new technology will give them a feeling of knowledge and power, thereby increasing their acceptance of the technology and motivation to perform the desired behaviors (e.g., Wilson & Haines, 1997). For example, this has proven successful in one organization specializing in the production of nuclear weapons (Caccamise, 1995).

Second, organizations must *avoid normalization of deviance* (avoid letting unsafe practices become the norm) by discouraging employees from cutting corners that may jeopardize safety (Vaughan, 1996). Normalization of deviance has been cited as a contributing factor in the space shuttle *Challenger* accident in 1986 (Vaughan, 1996).

Tip 2. Make people believe in and support safety . . . starting at the top. It has been suggested that a significant precursor to accidents may be employees' safety attitudes (including attitudes toward the use of technology) and that some management practices may influence safety attitudes in organizations, such as employment security or wages based on occupational safety (e.g., increased pay for working under hazardous conditions; Barling & Zacharatos, 1999). Therefore, it is important to create positive safety attitudes that express care and concern for errors and hazards and that show concern about the impact that errors and hazards have on all people at all levels in the organization (Barling & Zacharatos, 1999; Pidgeon, 1998).

To accomplish this, organizations must *get a commitment from upper-level managers* that supports and encourages safety policies and procedures. This commitment will help to ensure that normalization of deviance does not occur (see Tip 1). In addition, managers must *provide feedback to employees* on their safety performance. Without support from those said to be enforcing safety, employees will have

TIPS AND THEIR EXPLANATIONS FOR DEVELOPING A SAFETY CULTURE

Tips	Considerations
1. Send appropriate signals that safety matters . . . clearly and precisely communicate them.	• Create written policies and procedures for safety (Degani & Wiener, 1997). • Get employees involved (e.g., participatory ergonomics; Wilson & Hanes, 1997). • Avoid normalization of deviance (Vaughan, 1996).
2. Make people believe in safety . . . start at the top.	• Get a commitment to safety from upper-level managers (Pidgeon, 1998). • Encourage management to openly demonstrate their commitment (Barling & Zacharatos, 1999). • Provide feedback to employees so they will know how they are performing (Barling & Zacharatos, 1999).
3. Promote error checking . . . encourage continuous learning.	• Develop a continuous learning climate (Hofmann & Stetzer, 1998). • Encourage employees to routinely check for errors (Helmreich et al., 1999). • Encourage employees to learn from their mistakes (Pidgeon & O'Leary, 1994).
4. Open communication is a must . . . encourage it.	• Have good information flow throughout all levels of the organization (e.g., workers and managers; Barling & Zacharatos, 1999). • Encourage employees to speak up (Jentsch & Smith-Jentsch, 2001). • Encourage managers to share information with employees.
5. Search for solutions . . . examine all levels and promote different methods.	• Explore solutions to errors from many different angles (i.e., macro and micro). • Use an existing accident investigation technique to explore errors (e.g., Haddon matrix, Haddon, 1980; HFACS, Wiegmann & Shappell, 2003).
6. Encourage documentation of errors . . . create an error-reporting system.	• Develop a voluntary, nonpunitive error-reporting system (Pidgeon & O'Leary, 1994). • Encourage employees to report errors that went undetected by management (Barling & Zacharatos, 1999).
7. Prepare people through training . . . provide the competencies needed.	• Follow eight key steps to systematically design, implement, and evaluate a training program (Salas & Cannon-Bowers, 2000, 2001): ▪ Conduct a training needs analysis. ▪ Consider external factors. ▪ Establish measurable and task-relevant training objectives. ▪ Determine what methods to use. ▪ Determine what instructional strategies to use. ▪ Develop realistic training scenarios. ▪ Evaluate training. ▪ Ensure transfer of training back to the job.
8. If you don't know it's broken, you can't fix it . . . measure/assess safe behaviors.	• Continuously examine ongoing behaviors to determine if trained behaviors are being applied on the job. • Examine safety at multiple levels (Kirkpatrick, 1976).
9. You get what you ask for . . . reward the right behaviors.	• Avoid encouraging and supporting behaviors that the safety culture is trying to discourage (Kerr, 1995).
10. Effective coordination and communication is a must . . . promote teamwork.	• Promote interdependencies among team members. • Encourage members to coordinate and communicate at the team level (Salas & Cannon-Bowers, 2001).

little motivation to adhere to safety policies and procedures. The more that workers see and believe management's commitment to safety, the more likely they will be to develop positive safety attitudes and improve performance. Research by Zohar (1980) showed that management support was important in industrial settings.

Tip 3. Promote error checking . . . encourage continuous learning. The purpose of a continuous learning climate is to *encourage employees to learn from their mistakes*, not to hide or cover them up. Therefore, employees must routinely check for errors in order to avoid, trap, or mitigate the consequences of those errors before a serious accident occurs (Helmreich, Merritt, & Wilhelm, 1999).

Additionally, the learning climate must be encouraged and supported by managers at all costs. A learning climate will be hindered by a punitive climate in which fingers are pointed when an error occurs (Hofmann & Stetzer, 1998). As such, blame should not be placed on those who err (Westrum, 1987, as cited in Pidgeon & O'Leary, 1994). Rather, the cause of the error should be investigated (not just the outcome of the incident), and when its cause is determined, the entire organization should learn from it (Barling & Zacharatos, 1999).

Tip 4. Open communication is a must . . . encourage it. Organizations can promote a learning climate (see Tip 3) by *having good information flow* between upper management and workers (Barling & Zacharatos, 1999). It is important that employees feel comfortable communicating their ideas and opinions about new technologies and the policies and procedures developed to accommodate them. For example, employees at all levels of the organization should feel comfortable asserting themselves even when their concerns may be in conflict with the ideas of management (e.g., Jentsch & Smith-Jentsch, 2001). Employees must believe that mistakes happen and that learning from them is encouraged and supported regardless of cost.

Tip 5. Search for solutions . . . examine all levels and promote different methods. Many accident investigation techniques in organizations focus on searching for answers at the micro or individual level - that is, placing blame on and correcting the deviant behavior of the worker. Yet we have found a number of studies suggesting that accidents may be the result of factors beyond the human operator's control that lie latent within the organization (e.g., safety culture) and that need to be addressed. Typically in complex systems, there is a chain of events that leads to the user. Any breakdown in the chain can lead to an error. Therefore, when investigating accidents, organizations must address problems at all levels of the chain.

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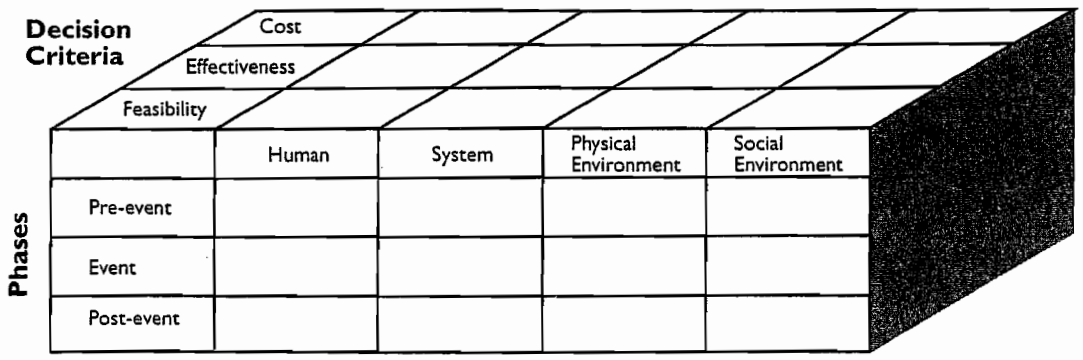
For instance, managers' negative attitudes toward technology can filter down to the worker, leading to errors. In this case, blaming the worker will not correct the problem. The primary source of the errors needs to be investigated – the attitudes of management. To help examine errors from a macrolevel perspective, we encourage organizations to *use an existing approach* if a system is not already in place. For example, the Haddon matrix, first developed and explored in the field of epidemiology (Haddon, 1980), today provides organizations with a three-dimensional approach to investigating accidents and incidents (see the figure below).

Tip 6. Encourage documentation of errors . . . create an error-reporting system. Organizations should encourage employees to document errors by *developing an error-reporting system* to track incidents that were known to the worker but went unnoticed by managers. A voluntary, nonpunitive system, such as that implemented in aviation (Aviation Safety Reporting System; see Orlady & Orlady, 1999), would allow workers to report an error without the fear of blame and retribution (Westrum, 1987, as cited in Pidgeon & O'Leary, 1994). This system would help managers to determine what caused the error or incident and would enable the entire organization to learn from it (Barling & Zacharatos, 1999). A punitive climate, on the other hand, will encourage employees to cover up mistakes and not discuss them openly (Hofmann & Stetzer, 1996).



The Haddon matrix for evaluating incidents (adapted from Runyan, 1998).

Tip 7. Prepare people through training . . . provide the competencies needed. For about two decades, researchers have argued that training is necessary to ensure the proper use of technology, to encourage safe behaviors, and to reduce human error (see Jiang & Gainer, 1987; Ziskovsky, 1984). Yet many training programs fall short, for two reasons. First, many programs only provide the basic training needed for workers to interact with technology, usually the minimum required by law. Time constraints and costs are often cited as reasons why only minimum training is given. Second, there is a "science of training" that organizations do not follow – that is, they fail to design, develop, implement, and evaluate training systematically (see Salas & Cannon-Bowers, 2000, 2001).

In addition, there are many myths about training to which training developers can fall prey (see Salas, Cannon-Bowers, Rhodenizer, & Bowers, 1999; Salas, Wilson, Burke, & Bowers, 2002). Resource management training has been successfully provided in many domains (e.g., aviation, nuclear) as a means to improving safety (Salas et al., 2001). Considering the extent to which training significantly affects a worker's performance and efficiency, it should be based on what is learned from the accident investigations, be developed to correct deviant behaviors, and encourage the safety culture desired by the organization (Harvey, Bolam, Gregory, & Erdos, 2001).

The purpose of a continuous learning climate is to encourage employees to learn from their mistakes, not to hide or cover them up.

There are eight primary factors to be considered when designing and developing a training program. Space limitations do not allow a thorough discussion of these factors here, but they are noted in the table on page 27, and we encourage readers to see Salas and Cannon-Bowers (2000) and Wilson, Priest, Salas, and Burke (in press).

Tip 8. If you don't know it's broken, you can't fix it . . . measure and assess safe behaviors. Following safety training, it is important that organizations assess whether the appropriate safe behaviors were learned and transferred to the actual task environment. Furthermore, organizations must *continuously examine ongoing behaviors* to determine if trained behaviors are being applied on the job over time. If they are not, and unsafe behaviors are uncovered, corrective measures need to be implemented.

Kirkpatrick (1976) developed a four-level typology for evaluating training (reactions, learning, behaviors, and organizational impact). A recent paper by Salas et al. (2002) emphasized the need to evaluate training at multiple levels; these researchers suggested that positive reactions to training do not guarantee learning, and, additionally, learning does not guarantee that trained behaviors will be applied on the job. Although many organizations assess trainees' reactions (because it is the easiest to measure!), they must also assess other levels to ensure that the trained safe behaviors are applied on the job and that they last over time. By using methods of behavioral measurement, organizations can pinpoint problems and incorporate them into future training programs.

Tip 9. You get what you ask for . . . reward the right behaviors. One of the biggest follies in organizations is that the *wrong behaviors are often rewarded* (Kerr, 1995). In an attempt to reward safe behaviors, organizations will actually encourage and support those behaviors that the safety culture is trying to discourage.

For example, consider the development of a voluntary error-reporting system. The purpose of the system is to learn from errors and mistakes, but the requirement of some systems that employees submit identifying information with the report so that they may be contacted at a later date for more information will likely discourage them from reporting. Therefore, an unsuccessful safety culture may be attributable to something that the organization least expects. They must be cognizant of the fact that corrective measures need to be taken to *reward the right behaviors.*

Tip 10. Effective coordination and communication is a must . . . promote teamwork. Many organizations rely on teams to accomplish their goals. For example, the medical community promotes teamwork as a means for improving safety (e.g., Small, 1998). Teamwork is characterized by a set of flexible and adaptive behaviors (what team members do), cognitions (what team members think), and attitudes (what team members feel) – in other words, competencies (Salas & Cannon-Bowers, 2001).

Organizations must *encourage members to work together* by coordinating and communicating at the team level. The synchronized collective action of team members requires a collection of processes, strategies, and actions that allow team members to effectively and efficiently perform interdependently. Teamwork competencies naturally lend themselves to safer work environments, so teamwork must be promoted and supported by managers in order to be successful.

In Closing

With increasing technology comes a greater likelihood of errors and a greater need for an integrated, macrolevel approach to safety. We hope we have succeeded in promoting an understanding of issues that influence safe practices in organizations through the foregoing tips that organizations can use to develop a positive safety culture that embraces technology.

We and other researchers have been arguing for some time that organizations should take a macrolevel approach to improving safety (e.g., Imada & Nagamachi, 1990). If they are, why has there been so little implementation of this approach? Are organizations afraid of what they may find? The threat of error will always be a possibility as humans interact with technology, so why not approach error proactively? Developing a positive safety culture is a welcome start

in the right direction. We put forth this challenge to organizations – to critically evaluate themselves to ensure that their workforces remain safe as technology is integrated into their work environments.

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