DEVELOPING AN EFFECTIVE CORRECTIVE ACTION PROCESS: LESSONS LEARNED FROM OPERATING A CONFIDENTIAL CLOSE CALL REPORTING SYSTEM

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In 2007, the Federal Railroad Administration (FRA) launched C[3]RS, the Confidential Close Call Reporting System, as a demonstration project to learn how to facilitate the effective reporting and implementation of corrective actions, and assess the impact of reporting close call events on safety. This paper describes some of the challenges and remedies in establishing effective problem identification and corrective actions processes when setting up an event reporting system like C[3]RS.

Introduction

In high hazard industries, like railroad operations, bridging the gaps between event reporting, problem identification and implementation of solutions presents significant challenges to the effectiveness of reporting systems. This paper tells the story of challenges that emerged during the implementation of a confidential close call reporting system in the U.S. railroad industry and efforts to address them.

In 2007, the Federal Railroad Administration (FRA) launched C[3]RS, the U.S. Confidential Close Call Reporting System, as a demonstration project. One goal was to learn how to facilitate effective reporting and implementation of corrective actions. A second goal was to assess the impact of reporting close call

events on safety. Two freight and two passenger railroads participated in the demonstration project. Each railroad began participating one at time, over 4 years. As new railroads joined C^{3}RS, we changed the implementation process based on lessons learned from earlier experiences.

Prior to launching the system, stakeholders representing labour organizations, railroad management, and the regulator met to identify the principles that would underlie the system and create a framework for how the system would operate. The principles and processes were documented in a model Memorandum of Understanding (MOU).

C^{3}RS system structure and operation

Figure 1 shows the reporting process. Before a railroad agreed to participate, the FRA's implementation team educated the stakeholders (railroad management, labour, and FRA field staff) on how the reporting system worked. Since the model MOU lacked all the details necessary for implementation at each railroad, the stakeholders negotiated the details to operate the reporting system. This new document was referred to as an Implementing Memorandum of Understanding (IMOU). For example, the IMOU specified the geographical boundaries where employees could submit reports and which labor crafts would participate. Educating participants and customizing the IMOU played an important role in building trust among the stakeholders and modelling the partnership that continued when C^{3}RS began operation.

Following the agreement by the stakeholders, each party selected members from its own organization to participate on a Peer Review Team (PRT). The PRT analyzed event reports and recommended corrective actions to the railroad. This group also developed materials and communication strategies for educating employees and managers on how to use C^{3}RS and its benefits to the railroad.

Once the system began operation, employees submitted written reports to a third party. The third party interviewed the employee to clarify the information in the written report and requested additional details about how the event unfolded. The third party prepared a de-identified event report for the railroad's use. The de-identified report removed information that could identify the reporter or people involved. If multiple employees submitted a report on the same event, the report included information from all reporters. After event reporting began, the railroad analyzed the reports, developed, and implemented corrective actions. Except for forming the PRT to identify causal factors, the railroad could choose whatever methods, tools, and processes to inform its analysis and take whatever actions it considered appropriate.

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The railroad was responsible for implementing corrective actions, monitoring their impact, and providing feedback to employees. The railroad also shared the results of its analyses, recommended and implemented corrective actions and their impacts, with the third party. This information served as a shared resource from which the regulator and the industry could learn about safety problems and effective ways to address them.
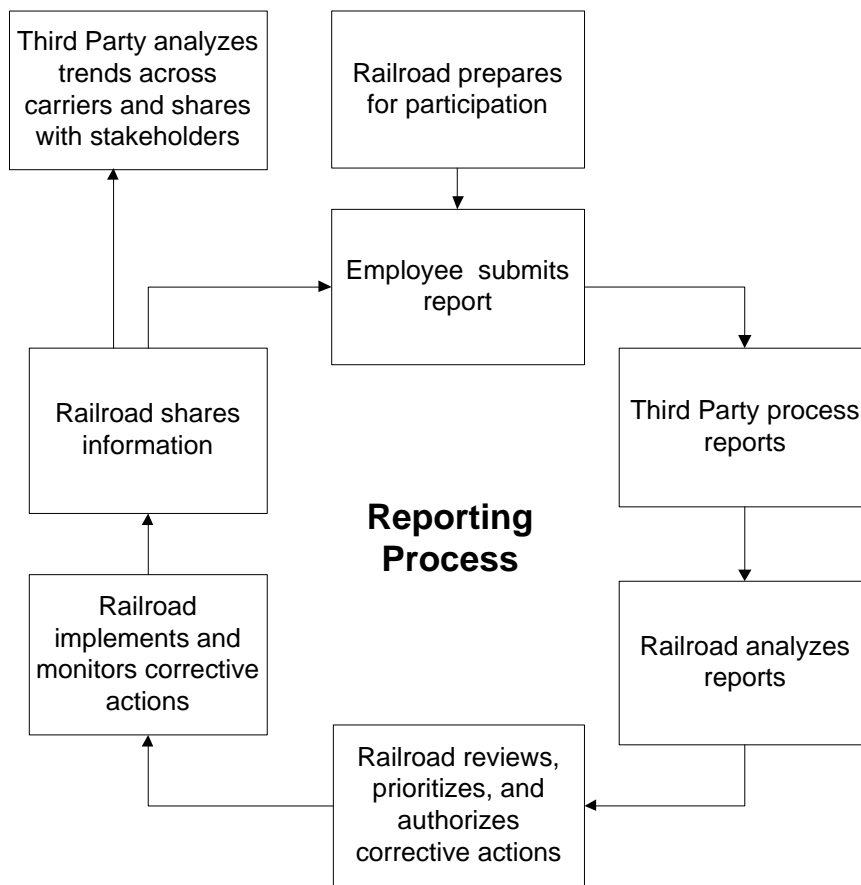

Figure 1: C³RS Reporting and Corrective Action Process

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Challenges encountered

In developing the C[3]RS model and implementing it, the FRA implementation team benefited from the existing literature on confidential close call reporting systems. Van der Schaaf, (1991); Johnson, (2003); Reason (1998); and Phimister (2000) provided valuable insights for setting up an effective reporting system. Our team learned from the Aviation Safety Reporting System (ASRS) and the United Kingdom's Confidential Incident Reporting and Analysis System (CIRAS); Davies et al., 2000). We applied the lessons learned from this research to our implementation of C[3]RS.

The decision to send event reports to the railroad for analysis arose from three ideas. First, local knowledge about organization dynamics and operating practices would enable the railroad to better identify problems than outsiders. Second, the involvement of multiple stakeholders in analysis and problem solving would contribute to a richer analysis and broader set of corrective actions. Third, the railroad's involvement in identifying causes and development corrective actions would result in greater likelihood of implementation.

Several challenges implementing C[3]RS arose from the decision to send the event reports to the railroad. These challenges emerged around the problem identification and corrective action processes. The rest of this paper describes how the implementation team collaborated with the participating railroads to address these challenges. Many of these challenges involved organizational barriers that contributed to ineffective problem solving and decision making combined with the consequences of how C[3]RS was implemented.

Challenge 1: Event analysis hampered by process for selecting PRT members and managing meetings

Several problems emerged from the process by which the railroad organized itself to analyze events and implement corrective actions. These processes involved selection of employees involved with C[3]RS, communications, and meeting management. The first problem emerged from the process for selecting PRT members. The leadership within each stakeholder group selected members to participate on this team. Management and FRA leadership selected one or two members to participate. Labour leaders from each craft selected employees representing each geographical territory within the demonstration site. With multiple territories at each demonstration site, the labor representatives formed the largest stakeholder group. The size of the PRT ranged between 12 and 24 people. The large number of labour representatives grew out of a desire by the labour leaders to each choose representatives to represent their interests. While a large group facilitated communications with employees and promoted credibility

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with the employees represented by the labor crafts, its size hampered effective event analysis. The size of the group limited the frequency with which it could meet due to budget constraints. Since the railroad paid for the time each manager and labor representative spent doing event analysis as well as for someone else to perform the work that the PRT members would normally do, management determined how much time was available through the budget they established.

We developed a list of knowledge, skills and abilities (KSAs) that the stakeholder leaders could use in selecting future PRT members. While the use of these KSAs helped, stakeholder leaders also weighed other considerations in deciding which people to select.

The large PRT group size also made it hard to manage. As a result, the PRT did not initially organize itself to manage all the activities needed to perform event analysis activities and use their time effectively. Who would lead the meetings? Who would document the results of their work? Who would communicate with the third party? We worked with the demonstration sites to create several strategies to address these constraints. We proposed a set of leadership roles within the PRT to assist them in managing their activities. These roles consisted of a facilitator to manage the meetings, a scribe to document their work, and a process manager to coordinate administrative issues such as when meetings would take place and obtaining resources. The people selected for these roles received additional training to perform their duties. Assigning people to the three roles contributed to more effective meetings.

To address the large membership, we recommended reducing the number of people attending each meeting. After learning about this challenge at the first site, we recommended that stakeholders at subsequent sites adopt the smallest group possible with representation from each organization. One PRT adopted a second strategy of alternating member participation at meetings. This procedure enabled members to maintain their skills, while keeping the group smaller. In a third strategy, a PRT formed a separate team to review the cases prior to event analysis by the larger group. This strategy enabled the group to prioritize the reports and spend their time on those reports that made the best use of their time. These strategies all contributed to more effective management of the PRT's workload. Reducing the size of existing PRTs proved more difficult, since the members valued the opportunity to do this work. They universally felt the event analysis served a valuable purpose and wanted to stay involved. We continue to seek effective solutions to optimize PRT effectiveness and manage costs.

To address the communication tasks, we recommended creating a group of "ambassadors" that would serve as a communication link between the PRT and

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employees. The ambassadors shared concerns from employees with the PRT and shared information that the PRT wanted to communicate with employees. This group matched the need of labour crafts leaders to play an important role for which they were well suited: sharing information between employees and PRTs. Program ambassadors also included managers to communicate the value of the program to their peers and to identify management concerns that needed to be addressed. By establishing a "larger" group of employees to facilitate communications, the railroad could keep the PRT smaller and focused on the analysis of event reports. Where it was used, the opportunity for face-to-face conversation with employees worked well as a mechanism to share information between PRTs and employees.

Challenge 2: Loss of project champions
A second challenge involved the loss of project champions. Project champions were people within the organization, usually managers, who took an active interest in the project and used their strong belief in the value of C^{3}RS, good relationships with others, and authority to get others engaged in the project. They acted as vocal project proponents to articulate the project's vision and inspired others to participate. Articulating a vision and set of values (developing an environment of trust and collaboration) that contrasted with a more traditional rules-based, command and control culture took courage on the part of the project champions.

At each of the demonstration sites where the FRA implemented C^{3}RS, project champions left due to promotions, retirements, and job changes. Finding subsequent management champions who shared the same passion or appreciated the value of a close call reporting system proved difficult. The senior management replacement frequently lacked the same passion for the project or lacked the vision for leveraging the project to benefit the railroad in new ways, as the initial champions did. Over time, some of the project champions changed from neutral participants to enthusiastic supporters. This process took time as they learned from experience how the reporting system benefited their stakeholder organization. Following the loss of a senior project champion, the program was vulnerable to a loss of support and resources. The challenge, which remains, is how to find subsequent project champions who believe in this initiative and want to participate. We worked with the railroad to set up succession planning so that the railroad could take responsibility for replacing key participants when they left. To address changes in PRT membership, we worked with stakeholders to insure that multiple people could serve in the PRT leadership roles. Overall, railroads with management champions at the most senior levels fared the best with this challenge.

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Challenge 3: Addressing gaps in event reports

Close call reports provide an opportunity for employees to tell their story. These explanations provided insights into the context for decisions and actions by employees that the railroad could use to better understand why an event unfolded as it did. However, unlike accident investigations in which investigators collect multiple sources of information, close call reports only provided one perspective: that of the reporter. To gain a more complete picture of how an event unfolded requires the story from everyone who played a role in the event. In practice, this was infeasible, as employees located far away in space and time from event were unaware that an unsafe event occurred. In addition, there was no way to collect information from a de-identified report on the state of track infrastructure or rail equipment unless the reporter addressed it.

The PRT frequently expressed frustration with the gaps in the close call reports. Gaps occurred for a variety of reasons. In some cases, the reporter observed the close call involving others, so they lacked information about those employees' intentions. Other gaps occurred when an employee chose not to provide details that could help the PRT understand why the event occurred. PRT members cited lack of time, writing ability, and motivation as factors contributing to reporting gaps. Some reports lacked details because the third party analyst preparing the report missed the significance of the information and excluded it or removed it to protect the reporter's confidentiality. The current process also protected all members of a team when only one member reported. To encourage reporting events involving rule noncompliance, employees received protection from discipline. This protection extended to an employee's immediate coworkers, even when they did not submit a report. As a result, a team member whose report could improve the PRT's understanding of the event might not submit a report.

The PRT's frustration with gaps in the event reports also grew out of a process that relied on information in the event reports to inform their analysis. With one important exception, they collected no other information, in spite of our urging to seek other sources. Where an event touched on operations outside the PRT's expertise, (e.g., maintenance operations), the PRT consulted with subject matter experts to learn how employees in that domain performed their work related to the event. Other types of information we recommended the PRT seek included: observations of current work processes, interviews with employees in the field, and automated data collected by the railroad such as from event recorders.

If the PRT wanted to collect information from additional sources, they were limited by several constraints. Given the time allocated to event analysis, most PRTs lacked the time and skills to conduct these investigations. Additionally, it was unclear whose job it was to conduct these additional investigations. While

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the C^{3}RS model specified that the PRT would support the events analysis, it did not preclude events analysis by others within the railroad. The model specified that the railroad was responsible for reviewing, authorizing, and implementing corrective actions. However, the C^{3}RS model did not specify where the analysis work of the PRT ended and analysis by others within the railroad began. In practice, if the PRT recommended additional investigation to better understand the problem, the railroad management might ask the PRT members to conduct this investigation. However, without sufficient skills, resources, and/or authority, they struggled to accomplish this work.

The PRTs adopted several strategies to close the information gaps that frustrated their analysis efforts. The PRTs worked with the third party to improve the quality of reports. The PRT provided questions on particular topics (e.g., job briefings) that the third party analyst would ask in subsequent interviews. The third party set up a process where employees could submit supplemental materials such as maps, and written documentation that played a role in the event. The PRT also reached out to employees to ask everyone involved in a close call event to submit their own reports. The PRT asked employees to encourage their team mates to report when they experienced a close call event. The PRTs also proposed changing the process for receiving protection from discipline to require each person to submit a report to receive protection.

We worked with the PRTs to create report examples so employees understood what a well written report contained. Finally, we recommended including in their corrective action recommendations, the need to investigate the problem more deeply or to ask for resources to investigate the issue themselves when their analysis was incomplete. Without collecting additional sources of information and investigating the operating practices for which an employee submitted an event report, the PRT would miss valuable information for identifying how systemic factors impacted safety. We also recommended that the railroad align the PRTs work with other parts of the railroad engaged in similar work.

While these strategies for improving the quality of the reports helped, the strategies could not bridge the gap associated with the processes and conditions that lay outside of the PRT's knowledge or understanding. Bridging this knowledge gap requires including people with the knowledge, skills, and abilities to collect additional information and investigate existing processes to understand how current operations created systemic risks. A future challenge is how to demonstrate to railroad management the value in learning from these events.

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Challenge 4: Incorporating operational knowledge that goes beyond frontline employees

The benefits of including frontline workers and managers in the event analysis process lies in their knowledge of actual work practices compared to how work is designed. They can offer insights into how work is done, that outside analysts cannot (Dekker, 2011; Meadows, 2008). The collaborative process of frontline employees and managers working together with the regulator built trust among the stakeholders as they learned to work together. The collaborative problem solving process also enabled them to appreciate different perspectives that lead to solutions that focus on problem solving rather than fixing blame.

However, the PRT's expertise was limited by their domain knowledge of railroad operations (train and switching operations). Their event analysis and corrective action recommendations were constrained by their limited knowledge of other parts of railroad operations, (e.g., maintenance, supplier and customer operations, etc.). In the same way that railroad employees not involved in train operations lacked knowledge about train operations, PRT members lacked the knowledge and perspective that these other employees brought to the analysis. So PRTs, whose membership relied on frontline employees, identified causal factors with which they were familiar. However, they missed causal factors that lay outside of their work experience. Our review of their event analysis indicated that PRTs produced corrective action recommendations that focused more on local solutions or problem symptoms than on systemic explanations. Identifying the systemic factors that originated elsewhere in the organization was difficult, because they lacked the awareness to consider these causal factors. This is consistent with the concept of bounded rationality in which people have finite capabilities and cannot consider all the possibilities that may be relevant in complex problems (Woods and Cook, 1999; Meadows, 2008).

To address this challenge, we made several recommendations. We recommended including subject matter experts from other domains or departments to support the event analysis. Second, we recommended expanding the PRT's analysis beyond the event reports themselves to investigate the underlying business processes and operational practices. Third, we proposed that the railroad create a cross functional group to augment the PRT's work, which we called a Support Team. The Support Team's responsibility was to review the event analysis and corrective action recommendations and decide how to proceed. They could recommend additional investigation and/or authorize implementation of corrective actions. As employees who were not involved directly in train operations, they could provide a broader perspective on the recommended corrective actions.

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The subject matter experts from other departments and domains provided valuable insights into how these other groups performed their work. Their support contributed to a variety of effective corrective actions. Support Teams increased the engagement of railroad managers and they provided a valuable perspective to event analysis reviews and corrective action recommendations. However, the Support Teams lacked time to contribute to insights that could provide a more systemic view of why unsafe events occurred. Bridging this gap could involve delegating their work to staff with a comparable view.

Conclusions

So what do these challenges to the event analysis and corrective action process tell us about implementing event reporting systems? We adapted the lessons from other close call reporting systems and the existing research on how to design effective reporting systems (Van der Schaaf, 1991; Johnson, 2003, and Phimester eta al, 2000), to meet the needs of the railroad industry stakeholders. We learned that our implementation process interacted with the organizational structures at the participating railroads to produce unintended consequences. We learned how our ability to implement this reporting system was constrained by the organizational factors within each railroad as well as by the C^3RS implementation process itself.

The decision to send event reports to the railroad to identify and implement systemic corrective actions posed a variety of unanticipated challenges. These challenges included:

- Identifying who should do this work and how to manage meetings.
- Sustaining the system when project champions leave.
- Addressing gaps in event reports.
- Collecting perspectives that address multiple layers within the organization.
- Identifying systemic issues and their corrective actions.
- Setting up a cost effective project structure.

Working with the participating railroads, we implemented a variety of actions to address these challenges. These corrective actions varied in their effectiveness. Multiple overlapping factors contributed to these challenges at each railroad. These factors included physical, psychological, and social structures (Repenning and Sterman, 2001). In complex systems, no one has a complete view of how new technologies and processes will impact the organization (Meadow, 2002). Addressing this complexity calls for including people across the organization to manage the many ways that problems arise in organizations. Managing complexity also requires a systems or holistic view of the organization where

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interactions between organizational elements can be addressed Dekker, 2002; Meadows, 2008; Leveson, 2011). Safety professionals should expect these challenges when introducing complex safety tools, methods and processes to railroads, airlines, hospitals, and other high hazards industries.

The kinds of challenges we faced in implementing an event reporting system for the U.S. railroad industry reflect the complex nature of sociotechnical systems. These challenges can be found in many other high risk systems from aviation to nuclear power (Carroll et. al, 2002). The dynamic nature of organizations means that sustaining the system will require the ability to monitor these systems for emerging challenges and adapting to these changes. Just as learning from failure requires trial and error, sustaining an event reporting and corrective actions process requires a continuous improvement process to adapt to the challenges that emerge over time.

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