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Team leadership: The Chilean Mine Case

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Introduction

The world watched in awe as the first of the 33 Chilean miners emerged from the transport tube. Without a doubt, the rescue of the miners in October 2010 was an impressive technological achievement. But perhaps the more enduring lessons from the mine may relate more to team leadership under what are now known to be among the most extreme conditions imaginable. Textbooks and popular books have been written on the subject of team leadership. However, the events that unfolded in the mine offer lessons for both students and managers alike on how to build and sustain a team that can survive hardships and change.

This exploratory paper will first present a summary of the Chilean mine incident. It will then present well-known frameworks for team leadership in organizations and reflect upon how the Chilean miner experience both illustrates and informs these frameworks. The goals are to advance a viewpoint that may be used to teach team leadership to students in an interesting and relevant way and to offer some new ideas for theory and research on team leadership in organizations. It is important to note that the Chilean mine disaster represented a multi-team system (DeChurch & Marks, 2006). There was a team working on the rescue above the surface and the team of trapped miners below the surface. Our discussion will draw from examples of each team, and also the interplay between them after contact was made with the miners with the drill. While our review is not exhaustive with respect to the literature on team leadership, it will be representative of the most commonly discussed issues in leadership in team contexts, including multi-team systems. Therefore, this paper will increase knowledge on leadership by
integrating previous research on teams to describe the success of team processes in this extreme scenario. This paper will also add to the literature on rare events (i.e. Baker, Day & Salas, 2006; Ciborra, 1999; Crossan, Cunha, Vera & Cunha, 2005) by presenting another scenario where improvisation is crucial to team processes.

**The Chilean Mine Case**

Prior to the accident, the Chilean mine team was most similar to a functional work team in which the members had moderate authority to determine work procedures and a strong leader. The team was cohesive, and accustomed to taking direction from their leader, shift foreman, Luis Urzua. Further, they had a history of working together, membership was stable and diversity was low. In terms of skills, the miners had minimal supplies to survive. There was a storeroom with two tanks of oxygen, and a limited amount of food and water (Franklin, 2011). The following quote from one of the miners describes the onset of the collapse:

> At about two o’clock in the afternoon, we were suddenly overwhelmed by the powerful thundering of rocks. The explosion of rocks was like a rolling wave that left us covered with dirt. There was a dense cloud of dust that would take four long hours to dissipate. The human soul tends to perceive these events in terms of their own story, but the first thing we all thought to do was to stand very still several seconds until we could get a better sense of the danger that had so abruptly interrupted our routine. (Henriquez, pp. 55-56).

Accounts of the Chilean miners’ social system during the days trapped under the ground reveal that the leader established priorities and that a democratic style of decision making emerged (Franklin, 2011; Henriquez, 2011). Alex Vega, mechanic, noted, “The hierarchy was
lost almost immediately…The thirty-three of us were one and we began a democratic system; the best idea that made the most sense was the idea that ruled” (as reported by Franklin, p. 61).

The Chilean miners clearly stayed focused on a goal, which was that all 33 men would survive. Urzua reinforced this goal by insisting that he would be the last miner to leave and he followed-through on this promise. During the days and nights in the mine, the miners remained focused on small tasks, such as food rationing – cookies, milk, cans of tuna and a can of peaches. They would each eat small portions every 48 hours, knowing that rationing was necessary because the food they had needed to last at least 3 weeks.

Miners had a high degree of role clarity related to their skill sets and there was a complementary skill set within the team (Klimoski & Jones, 1995). In the mine, there were electricians (one of whom was a medical worker), machine operators, drillers, mechanics, drivers, a hydraulic engineer, a topographer (also the shift foreman), a manger, and a supervisor (Henriquez, 2011, pp. 115-116). Urzua’s skills as a topographer were key, as he made a rough sketch to determine where they were located as one of his first tasks (Franklin, 2011). The medical worker’s skill set was very important as the physical conditions of the miners deteriorated while waiting for rescue due to dehydration, starvation, and lack of sleep. Problems started emerging immediately especially with regards to urinary tract obstruction, that had to be treated without medication (Fraser, 2010). He monitored each miner’s condition, and while scratched and bruised, there were no serious injuries from the blast. Some other miners monitored environmental conditions and others drilled for water (Fraser, 2010). All of the miners knew how to operate equipment, and used the equipment to make loud noises hoping someone would hear them.
On August 22, 2010, at 5:50 am, there was a key transition for the functioning of both teams. At first, the drill misses the miners. They miners heard it pass them, and then realized it was below them. The miners struck the drill with metal, and then painted it orange with spray paint they had in their mining supplies. They attached plastic bags with notes in them. The drill was drawn back up to the surface. At first the rescue team was not sure if they have found the miners on that try. But then they saw the orange paint and knew it was a signal. From that moment of transition, the multi-team system worked together to gather information from below through the notes and a camera to determine what supplies were immediately needed for survival while a plan was implemented to send the rescue capsule to them. The ordeal of starvation and fear had come to an end. The next task became one of rescue and coordination with the rescue team above.

The team leader divided the miners into three shifts, organized around their living arrangements. After contact was made with the rescue team, he followed the advice of experts on the surface and created a dark area for sleeping, a light one for community activities, and a dim area for work activities to simulate normal awake and rest periods. One of the first items sent down the tube created to send essentials to the team was a questionnaire to assess the health of each miner (Frasier, 2010). This was followed by glucose, electrolytes, and high-protein liquids before solid food was sent.

Urzua maintained control of a team in the most challenging of circumstances. He created a shared vision, used ceremonies and rituals (they held church services, prayed, and sung Elvis Presley songs to pass the time). His symbolic gesture to be the last one to leave the mine was a motivating force and they celebrated the small achievements such as the moment when they first saw the rescue capsule. Urzua adapted his leadership style from the military type style typical of
mining operations to a style where decisions were made in a democratic way; the miners reported that they each had a vote on important decisions after they were discussed. After all of the 33 miners were rescued, Diaz, head of the medical team that monitored the miners, reflected, “This has practically been a complete rescue…We have learned how important it is to have a cohesive group of workers…” (p. 1379).

**Team Leadership in Extreme Situations**

Most treatments of teams and team leadership begin with definitional matters relating to the type of team being considered. These types range from functional work teams, cross-functional teams, self-managed teams and top executive teams (Yukl, 2010). Teams have been defined as groupings of individuals who are interdependent and have a common purpose (Katzenbach & Smith, 1993). The Chilean mine team was a functional work team and members had some authority to determine work procedures. They also had a strong leader and a history of working together. It is important to consider these initial inputs to the team process since it is clear that they are related to how the team survived as the crisis unfolded. More importantly for this analysis, the mine disaster meets all of the criteria discussed in the literature on extreme or disruptive team contexts (Hannah, Uhl-Bien, Avolio, & Cavarretta, 2009).

This case illustrates the importance of the relationship of team inputs to the team process. The miners’ ultimate survival depended upon how they put both material and human resources to use by setting up a cooperative behavioral system. Additionally, it was clear that dynamic adjustment and improvisation was necessary for the rescue team to locate and save the miners. Our analysis will demonstrate the pivotal role of team leadership and the key process variables identified in research on teams that contributed to the survival of the miners.
Team Leadership in the Chilean Mine Case

Theory and research on leadership in extreme contexts is in its nascent stage. However, there has been increasing interest in the subject. Hannah, Uhl-Bien, Avolio and Cavarretta (2009) developed a framework for the examination of leadership in extreme contexts. They defined extreme contexts as those that have physical and/or psycho-social consequences for members that are “unbearable” and these circumstances challenge the organization’s ability to prevent them. The collapse of the mine is clearly an extreme context.

According to Hannah et al., the role of leadership in such contexts must be adaptive, and characterized by “…competence, support, structures, priorities, role clarity, effective communication, coordination, maintains cohesion, focus, calm, a sense of humor…” (p. 912). Klein, Ziegert, Knight and Xiao (2006) examined extreme action teams in an emergency trauma center. Their qualitative research showed that leadership was shared. Leaders engaged in a pattern of rapid and repetitive delegation, however active leadership was practiced by junior members of the team. These authors emphasized the importance of improvisation in the leadership role. They reported leadership functions of providing strategic direction, monitoring, providing hands-on treatment, and teaching the team members. They conclude, “Dynamic delegation of the active leadership role fosters learning and reliability…The hallmark of dynamic delegation is the rapid and repeated transfer of the active leadership role up and down the leadership hierarchy” (p. 613). The Chilean miners’ decision making tactics indicate a democratic style (Franklin, 2011; Henriquez, 2011). For example, all of the members were allowed to suggest ideas and the idea that made most logical sense was chosen. Therefore, a pattern of dynamic delegation described by Klein et al. is similar to the leadership style in the
extreme situation encountered in the mine. It differs in that there was central leader (Urzua) who coordinated all inputs from team members and the delegation of tasks.

Rico, Sanchez-Manzanares, Gil and Gibson (2008) discussed team-level knowledge structures and articulated a model of “team situation models” (TSMs), which they defined as “…dynamic, context-driven mental models concerning key areas of the team’s work such as the objectives or the roles of colleagues…” (p. 164). Their model incorporates two elements (1) anticipation and (2) dynamic adjustment. Interestingly, they use an example of firefighters engaged in fighting an apartment building fire to illustrate these two components. In this example, firefighters had to plan for the length of hose needed (anticipation) and then adjust to ensure the hose was not caught on the stairs (dynamic adjustment). The firefighter example is an extreme situation, and their model appears to be relevant for team leadership in extreme contexts. The rescue team in the Chilean mine incident exemplified the element of anticipation. They had the training and experience needed for rescues. However, as with every unique situation, dynamic adjustment was necessary to locate the miners. As noted in the case above, at first the drill missed the miners but the rescue team continued the trial and error process. This search process provides a vivid illustration of the process of dynamic adjustment. The drill locations were changed until the miners were ultimately located.

Once the miners were located, a transition occurred in the multi-team system. In a meta-analysis of research on teamwork processes, LePine et al. (2008) proposed that three intermediate-level teamwork processes may be employed to summarize the relationship of team processes and effectiveness. They found support for a second-order model, which included transition processes, action processes, and interpersonal processes, moderated by task interdependence and team size. Transition processes are important drivers of multi-team systems
as they will activate within-team as well a cross-team action processes (Marks et al., 2005). Further, performance is dependent upon goal hierarchies that are interdependent. The role of team coaching during transitions has been articulated by Hackman & Wageman (2005). Using examples of briefings of flight crew members, the authors discussed the importance of team coaching at the beginning of events. Strategic intervention may be needed at the midpoint and at the ending because it presents an opportunity for reflecting on task accomplishment. Examining critical incidents using historiometric analysis of hurricanes and post-war stability operations, DeChurch et al. (2011) reported that leaders play a critical role in the aftermath of critical contexts. Using an inductive method, they developed a framework for multi-team leadership functions involving strategic and coordinating behavior. Throughout the seventeen days in which the rescue team searched for the miners, there was clearly an interdependent goal of rescue and survival on the part of both the miners and the rescue team above. Coordinating behavior was essential for both teams to succeed and after seventeen days, when the drill bit pierced a tunnel near the miners’ shelter, coordination between the rescue team and the miners became essential.

**Leadership Lessons: Key Team Processes**

**Goal Commitment.** Commitment to goals and related specific tasks is essential. The Chilean miners had a specific goal—all 33 men would survive. The leader, Urzua, emphasized this goal and made it clear that he would be the last miner to leave. As mentioned in the case, the miners focused on small tasks such as food rationing and kept a strict schedule. This level of attention to detail was important to keep the team focused on the essentials. The interplay of goals and commitment was clear, as Urzua was able to maintain his leadership role. We believe that the Chilean mine case offers new insight into team leadership in extreme situations.
Research is needed to examine both the members’ and leader’s challenges and the process by which a leader maintains control of the team.

**Member skill sets.** Team skills are a second important team process. All of the miners had a clearly defined role that was suitable to their skills (Klimoski & Jones, 1995). As described in the case above, the medic’s skills were essential for immediate emergency situations. Another key skill set was Urzua’s skills as a topographer (Franklin, 2011). Creativity was needed to take inventory of the tools and equipment they had on hand, and think of new ways that it could be used. Their ingenuity contributed to their survival and each skill set contributed to the process. The role of creativity and innovation in extreme contexts appears to be an area that requires more attention with regards to both theory and research.

**Internal coordination.** Urzua, the team leader, coordinated the teams by separating the miners into three shifts that were organized around their living arrangements. He also followed the recommendations of the rescue team by creating different areas for the normal awake and rest periods for the team. This degree of internal organization and coordination has been shown by team research to be essential especially under rapidly changing conditions as members must adjust their behavior to the situation (Rico et al., 2008). The creation of smaller teams from the larger team of 33 enhanced cohesiveness and was a key process in the mine. Maintaining cohesion and cooperation was an essential strategy for their survival.

**External coordination and resource acquisition.** Seeking resources and support from external sources is another key process for leadership with regards to effective team performance (Marks et al., 2005). The collection of accurate information was a key aspect of determining the resources needed. As mentioned in the case, a questionnaire was used to assess the miners’ health (Frasier, 2010). This is an example of the need for accurate information prior to resources
being obtained; in the case of the miners, this might have meant life or death since many could not tolerate solid food right away (despite their dreams of eating empanadas right away). The team leader also maintained control of his team by instilling a shared vision and organizing ceremonies and rituals. He also led in a democratic fashion so that all decisions accounted for the miners’ different opinions. The miners also made an effort to celebrate the small achievements (i.e. first sight of the rescue capsule).

**Cohesion and Conflict Management.** Gupta, Huang & Niranjan (2010) showed that team leadership was related to performance; however, team cohesion and conflict mediated this relationship. Research in the management literature has repeatedly found cohesion (Beal, Cohen, Burke, & McLendon, 2003; Gully, Devine, & Whitney, 1995; Gully, Incalcatera, Joshi, & Beaubien, 2002) and conflict management to be two of the most fundamental team-level variables that influence team effectiveness (Tekleab, Quigley, & Tesluk, 2009). In the case of the Chilean mine, the goal was never in doubt: Survival and rescue was the goal. As mentioned previously, the minors worked together to clearly defined roles and developed a shared vision. They made all of their decisions collectively and democratically handled differences of opinion. When differences of opinion occurred, they discussed the best option for the ultimate survival of all of the members. These strategies demonstrate the miners’ strong cohesion and conflict management skills. What makes the case of the Chilean mine so fascinating is that the inputs and processes were the key to developing a sense of cohesiveness and effective conflict management that ultimately led to a positive outcome. As noted by Scandura (2010), “Teaming is so inherently natural that in times of crises, human beings intuitively know it is the pathway to their survival” (p. 7G). Reflection on the processes in the mine may hold much value in how we teach and conduct future research on teams in organizational settings.
Conclusion

We have much to learn from this case of extreme leadership and the insights that it offers for future research on teams. For team leadership to be effective in crises, there are key team processes that must be mobilized quickly and effectively. These processes have been identified in organizational research as noted above and may be critical to the effectiveness of team leadership in a variety of situations (Yukl, 2010). While these processes are comprehensive and explain much of the processes in the Chilean mine extreme leadership situation, it is clear that the literature needs more attention to the roles of spirituality and humor, which played key roles in the survival and well-being of the team in an extreme situation.

Our brief review of the literature on team leadership in extreme situations indicates that research has shown the importance of this topic. The Chilean mine disaster provided a case study through which the research findings were illustrated. Team leadership played a pivotal role in the ultimate successful outcome for the miners and all involved. Failure was possible in this extreme incident. Negative consequences could have surfaced if leadership was ineffective or if group processes were not in place. The situation provided an example of a multi-team extreme context where there was a need for coordination both within the team and with teams outside. Lastly, it is also important to consider that although team leadership affects performance, key team processes must be considered including goal commitment, internal and external coordination, resource acquisition, and cohesion and conflict management. This discussion of the Chilean mine disaster and rescue illustrates concepts from the literature on extreme situations and team leadership and indicates some areas that are in need of further research. This case study provides an interesting extreme context that may be used in teaching concepts from team theory and research. The rescue was no doubt a technological marvel.
However, the leadership and team processes offer lessons that we can bring to the classroom and to our research agendas.
References


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