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Abstract: Three years ago, when a cave-in at the San José mine in Chile trapped 33 men under 700,000 metric tons of rock, experts estimated the probability of getting them out alive at less than 1%. Yet, after spending a record 69 days underground, all 33 were hoisted up to safety. The inspiring story of their rescue is a case study in how to lead in situations where the stakes, risk, and uncertainty are incredibly high and time pressure is intense. Today executives often find themselves in similar straits. When they do, many feel torn. Should they be directive, taking charge and commanding action? Or should they be empowering, enabling innovation and experimentation? As the successful example of André Sougarret, the chief of the mine rescue operation, shows, the answer is yes-to both. The choice is a false dichotomy. Implementing this dual approach involves three key tasks. Each has directive and enabling components. The first task is envisioning, which requires instilling both realism and hope. The second task is enrolling, which means setting clear boundaries for who is on and off the team, but inviting in helpful collaborators. The third task is engaging-leading disciplined execution while encouraging innovation and experimentation. The authors of this article describe how Sougarret ably juggled all of these tasks, orchestrating the efforts of hundreds of people from different organizations, areas of expertise, and countries in an extraordinary mission that overcame impossible odds. **INSETS:** A Search and Rescue Timeline;The Dual Imperatives of High-Stakes Leadership. [ABSTRACT FROM AUTHOR]

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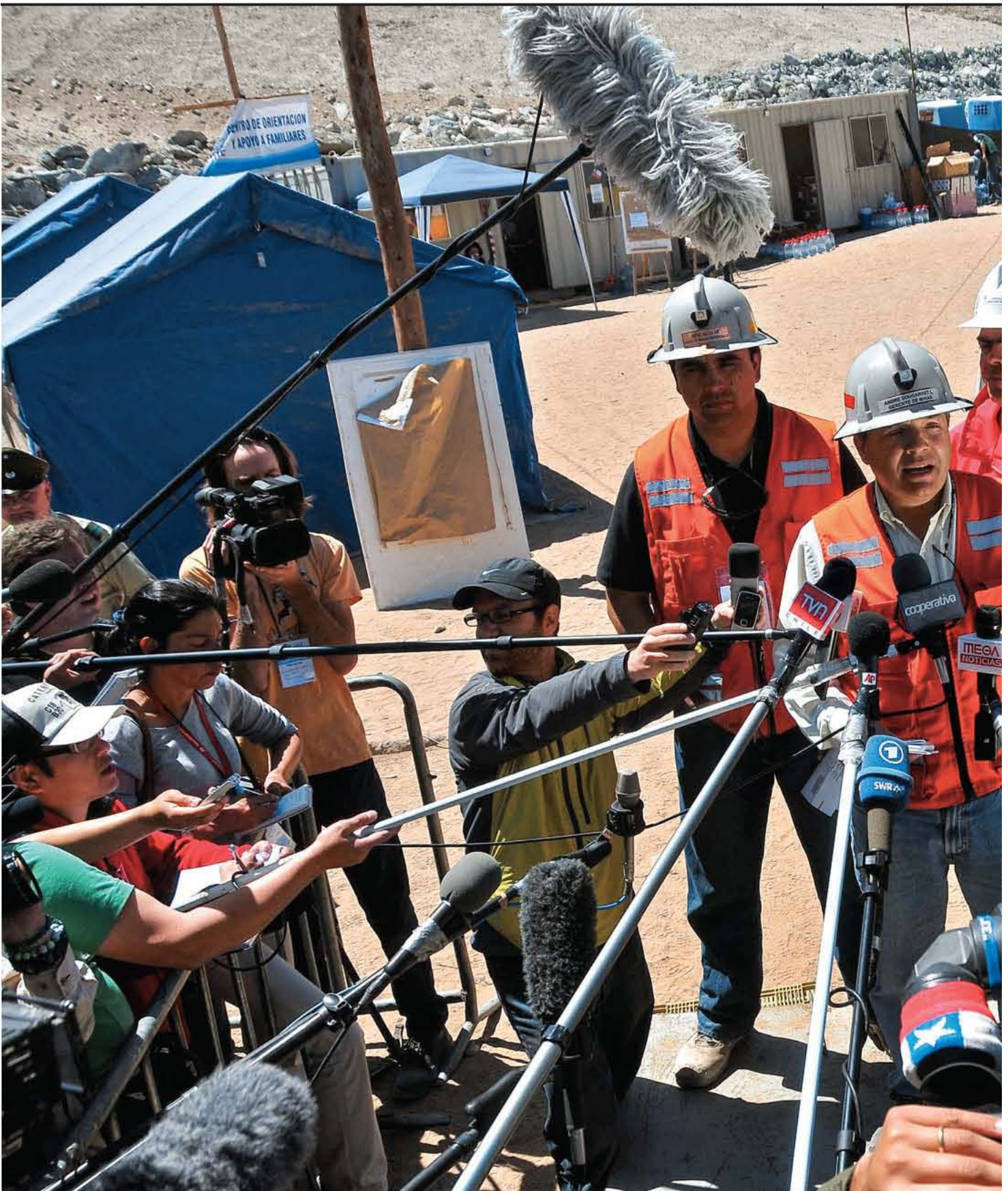
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Leadership Lessons from the Chilean Mine Rescue

A diverse -- and initially disorganized -- team demonstrated how to innovate and execute at the same time



André Sougarret, the chief of the rescue operation, briefs the press.

Early in the afternoon of August 5, 2010, more than 700,000 metric tons of rock suddenly caved in, blocking the central passage to the tunnels in the San José copper and gold mine in Chile's Atacama Desert. Shaken miners close to the entrance soon made their way out, but 33 men working deep underground were trapped beneath some of the hardest rock on the planet.

Accidents in underground mines are common, but this one was unprecedented on several dimensions: the depth at which the miners were entombed, the unstable rock

formation, and the mine's antiquity and notorious safety record, to name but a few. Two days later, after a second rock-fall blocked ventilation shafts, experts estimated the probability of locating and rescuing the missing workers alive at less than 1%.

Yet on October 13, after spending a record 69 days underground at a depth of 2,300 feet, Los 33, as the miners had come to call themselves, emerged -- fragile but alive. Once the last man had been winched to the surface, the rescue team held up a sign that read *Misión Cumplida, Chile* (Mission Accomplished, Chile), a sight seen by more than a billion TV viewers.

The San José rescue operation was an extraordinary effort, entailing leadership under enormous time pressure and involving teamwork by hundreds of people from different organizations, areas of expertise, and countries. People everywhere, including the three of us, watched it unfold with apprehension, amazement, and admiration. It wasn't long before we concluded that the story had much to teach executives about leading in difficult settings.

One of us (Rashid) flew to Santiago soon after the miners' rescue and conducted in-depth interviews with several key players. Our research became the basis of two case studies, which we've taught around the world. Through our work, we've gained fresh insights into the role that leaders should play in time-sensitive, highly risky, uncertain make-or-break situations.

While different in detail, the challenges that the San José rescue team's leadership tackled resemble those that senior executives often face in today's turbulent business environment. At every turn, organizations must deal with threats to their prosperity and survival. Risks are poorly understood, and countermeasures are unclear. Even opportunities are difficult to decipher. The past provides little guidance about what will work in the future, and executives must learn rapidly and execute reliably under extreme time constraints. These factors can make situations chaotic, which is discouraging and, often, frightening.

In such emotionally charged circumstances, most leaders feel torn. They worry: Should they be directive, taking charge and closely monitoring people? Or should they be empowering, inviting innovation and letting many experiments bloom? Our research suggests that the answer should be yes -- to both. The choice presents a false dichotomy.

In complicated and rapidly evolving settings, CEOs have to command action so that they can execute efficiently and capitalize on even fleeting opportunities. But it's also essential for them and their teams to learn quickly, to keep up with developing events and stay ahead of the competition. That will happen only if leaders foster creativity and openness, encourage exploration and invention, and facilitate cooperation across disciplines and perspectives.

To meet these conflicting demands, leaders must alternate between directing action and enabling innovation. At times, they must be decisive, give instructions, and periodically close down discussions so that the team can get things done. At other times, they must create space for new ideas, encourage dissent, ask questions, and promote experimentation. Leaders that lean too much toward either relentless commands or unchecked ideation do so at their peril.

The concept of duality in leadership has been discussed before in HBR. Stanford's James G. March pointed out the need for organizations to explore and exploit; Harvard Business School's Michael Tushman and Stanford's Charles O'Reilly introduced the idea of ambidextrous organizations. This article extends that thinking, unveiling a framework that leaders facing complex, high-pressure situations can use to integrate fast innovation and urgent execution.

As we will see, the response to the San José disaster unfolded in two phases: a 17-day search to locate and contact the miners, and a 52-day rescue, during which they were sustained and then pulled up to safety. Each phase focused on a different problem: The first entailed finding a needle in a haystack; the second, quickly designing and implementing a novel rescue system. However, to tackle both problems, the mission's leaders used the same seemingly contradictory approach: Control and empower. The leaders focused on driving work forward and looking for new ideas in unlikely places; they acted quickly and yet took time to reflect.

To effectively implement this dual approach, we find, leaders must perform three key tasks: Envision, enroll, and engage. These tasks must be done iteratively; imagine them as the nodes of a triangle, not steps in a process. At any time, the main emphasis should be on only one of them, and as the situation evolves, each will become the center of attention. Moreover, each task has directive and empowering components. To orchestrate a balance between them, leaders must constantly analyze their changing situation and environment.

Envision

Direct a Realistic Assessment and Enable Hope

To thrive in chaotic environments, teams need realism and hope. Leaders must promote both, by understanding what is and by envisioning what could be -- and by inviting others to participate in moving from the existing to the desirable.

Coming to grips with reality starts with conducting a clear-eyed assessment of the current situation and trying to anticipate any future consequences. But the gap between the present circumstance and the desired outcome can be psychologically overwhelming, immobilizing people. Therefore it's critical for leaders to inspire hope in followers. The management expert Jim Collins refers to the dual need for hope and pragmatism as the Stockdale Paradox, after the coping mechanism that U.S. Navy pilot James Stockdale used to lead his fellow captives in a North Vietnamese prisoner of war camp.

During the San José rescue, Chile's political leaders raised people's hopes and, at the same time, injected realism. Within hours of the accident, the country's then recently elected president, Sebastián Piñera, dispatched his businessman-turned-mining-minister, Laurence Golborne, to assess it firsthand. The moment the president learned of the impending tragedy, the immense technical difficulties confronting the rescuers, and the mining company's lack of capabilities and personnel, he realized that the government would have to take immediate charge of the rescue.

Context may have played a part in the decision; his predecessor had been criticized for responding too slowly to an earth-quake in February 2010, and there was a growing aspiration in Chile to be seen as capable of doing great things. Against key political advisers' recommendations and at significant political risk, Piñera flew to the mine site to meet a small group of family members and declare his unequivocal commitment to a rescue. His directive was clear: Bring home the miners, dead or alive, sparing no expense. Piñera thus articulated the gap between reality and hope, and made a pledge to close it.

He then turned to Chile's largest mining company, the state-owned National Copper Corporation of Chile (Codelco), for help. Its senior executives recommended André Sougarret, known for his composure under pressure, to lead the rescue. A mining engineer with over 20 years of experience, Sougarret managed El Teniente, reputed to be the world's largest underground mine. To help him at the San José site, he called on a handpicked team of 32 Codelco managers, including two mine superintendents, a communications expert, and a psychologist in human resources management (who took charge of the relational aspects of the operation). Four days after the accident, the president flew back to San José to introduce Sougarret to the miners' families.

At the accident site, Sougarret found chaos. Hundreds of people -- the missing men's relatives, other miners, health personnel, the press, and self-dispatched first

responders from the industry -- were flooding in, seeking answers, all adding to the turmoil. He and his team cut through the confusion to establish situational awareness (a high-level understanding of critical elements of a complex environment, employed by air traffic controllers, military leaders, and emergency personnel), assuming little and asking myriad questions.

Sougarret held conversations with mine workers and with geologists and drilling experts, such as BHP Escondida's Walter Véliz, Nicolás Cruz, and Marcos Bermúdez, and Codelco's José Toro, who had arrived at the accident site earlier. Through them he learned that if the miners had survived the collapse and followed protocol, they would have gathered at a small "refuge" located approximately 2,300 feet underground. The roughly 530-square-foot room held only enough provisions to feed 10 miners normally for two days and sufficient water for a month. But if the miners weren't hurt and maintained discipline and morale, they would be able to survive for a fairly long time. The danger was that they would still perish before rescuers could get to them.

Like the president, Sougarret offered the missing miners' families and the people of Chile a rational basis for hope without disguising the truth about the odds against them. In his first interactions with the media, he promised a determined effort, not a successful outcome. He explained his experience and expertise, his goals, and his absolute commitment to the rescue. However, Sougarret didn't shy away from describing the uncertainty and difficulties the rescuers faced.

Maintaining situational awareness became a never-ending task, as reality kept changing. At first Sougarret thought his team could reach the trapped miners by using the existing ventilation shafts and emergency tunnels to get to the lower maze of tunnels. The growing instability inside the mine and the secondary rockfalls that blocked the shafts quickly made this plan unworkable. The gap between the current state and the desired end had widened, and it was necessary to find a new way to bridge it.

It became clear to Sougarret that the team could rescue the miners only by drilling a borehole that intersected the refuge or the tunnels near it. However, creating a hole large enough to admit a rescue capsule might take months. The miners would never survive that long if they didn't receive more food and water. That realization led to a conceptual breakthrough: The challenge had to be broken into two parts. The first would involve quickly drilling a small (15 centimeters in diameter) shaft to locate the miners and provide them with critical supplies. The second would require drilling a shaft wide enough to extract the miners from an underground location almost two Empire State Buildings deep.

To be sure, the two-pronged effort seemed only remotely feasible. Drilling technologies' lack of precision, combined with the absence of accurate maps for the 121-year-old mine, meant that there was only a slim chance of drilling all the way to the refuge in time. Still, the idea reflected an important evolution in the leaders' understanding of the situation. It also allowed the rescue operation to divide its forces, freeing some to focus on the more difficult second phase even while the first was under way. This parallel processing, which became a hallmark of the operation, is actually a requirement for success in chaotic environments.

With a better understanding of the available options, Sougarret immediately got his team to focus on the search operation. The group's constant brainstorming produced several plausible solutions that the team could try. For example, the search operation encompassed drilling efforts at several sites that allowed more speed and accuracy and boosted the likelihood of success. Later, the rescue operation would similarly pursue multiple solutions at once, employing three different drilling systems -- Plans A, B, and C -- in parallel. Plan A was more reliable but far too slow for comfort. Plan B had the potential for the quickest adjustments, but its technology was untested. Plan C offered greater speed -- but less precision than seemed necessary. Together, these alternative approaches formed a rational and pragmatic basis for the belief that a rescue was possible.

Meanwhile, deep underground, the trapped miners confronted the physical and psychological challenges of survival. Under the calming influence of the shift supervisor, Luis Urzúa, they overcame three days of confusion and conflict to restore order and hope. Threatened by limited food and deteriorating health, the miners adopted a democratic leadership structure. They allocated daily tasks and resources, established living and waste disposal areas, and used the lighting system to simulate day and night. As they passed the time by sharing stories about their lives, the bonds among them deepened and they began calling themselves Los 33. In their grim situation, hope focused on the possibility of rescue and on maintaining their dignity even if rescue eventually proved impossible.

Enroll

Direct Boundary Patrolling and Enable Boundary Spanning

By definition, leaders don't exist without followers. At the San José mine, followers were in abundance. Chile's tightly knit mining community sent many experts and tons of equipment to the accident site. However, expertise without leadership is never enough -- as countless failures in organizations ranging from NASA to Lehman Brothers have taught us.

During times of uncertainty, leaders must enlist a diverse group of highly skilled people but ask them to leave behind preconceived notions and prepackaged solutions. Those specialists need to understand that no matter how experienced they might be, they have never before faced the challenge at hand. The group needs to explore, experiment, and invent together, and to integrate deep knowledge and ideas -- not just apply them. People have to work in fluid, shifting arrangements, rotating in and out of teams as the demands of the situation evolve.

To enroll followers, leaders must repeatedly present their vision of the end state. Even when the mission appears obvious, they must remind people what they're trying to accomplish and what's at stake; doing so infuses fresh meaning into work and recharges effort and ingenuity. For instance, to sustain enrollment despite the inhospitable conditions in the Atacama Desert and the lengthening odds, Sougarret would constantly highlight the core mission as saving lives.

Enrolling has a second side. It is as important to exclude unhelpful people and approaches as it is to invite in helpful ones. Leaders in chaotic environments must be willing to draw boundaries and actively turn away people whose efforts appear no longer relevant. After he took stock of the situation at San José, Sougarret established a "restricted access" perimeter beyond which he allowed only people with technical expertise and implementable proposals.

Sougarret and his deputies matched this inward focus with an equal outward focus. With the support of President Piñera, they reached out to their networks for new ideas and technologies, calling on organizations such as the Chilean Navy and United Parcel Service and on American drilling experts previously stationed in Afghanistan. Other organizations, such as NASA and Maptek, an Australian 3-D mapping software company, volunteered to help. The ideas that poured in were vetted by an off-site team in Santiago, some 500 miles away, which ranked countless proposals in terms of feasibility and interviewed people whose ideas seemed worthy of consideration.

Back at the mine site, Sougarret kept recruiting fresh expertise as the situation changed. As new specialists continued to arrive, he avoided imposing excessive hierarchy, anxious not to insulate himself from the dynamics on the ground. He kept in constant contact with various groups, regularly highlighting the interdependencies among roles, which were clearer from his vantage point than they were to those focused on individual projects. Sougarret was also quick to exploit the emerging collaborations and leadership dynamics he observed. For example, noting the deep respect that peers accorded Walter Véliz, Sougarret put him in charge of drilling operations during the search phase.

Within a week of the accident, as many as six drilling efforts were under way, but it wasn't clear whether any of them would hit the miners' shelter. Thankfully, more ideas

streamed in. One came from Felipe Matthews, a Chilean geologist who showed up at San José with a new technology for measuring drilling trajectories. A gyroscope-like probe could be inserted into a drilling hole and, regardless of the position of the mounted drill, find the vertical. After conducting tests, team leaders concluded that Matthews's equipment was the most accurate and consistent at measuring trajectories underground. Sougarret immediately put Matthews in charge of monitoring the accuracy of all drilling attempts and asked the other experts measuring drill profiles to leave.

During the subsequent rescue phase, a brilliant idea came from a 24-year-old field engineer, Igor Proestakis, who worked with Drillers Supply, S.A., and came to San José on his own. He believed that an American company's cluster hammer technology could cut through the hard rock quicker than other drills could. Matthews and Véliz listened to him, felt that he might be right, and immediately took him to Sougarret. "If you look at it from his [Sougarret's] perspective, this was probably the most important job of his life. Despite my experience and age, he listened to me, asked questions, and gave me a chance," says Proestakis, whose drilling team would ultimately be the first to reach the miners.

Just as leaders span boundaries to invite in more innovation, they must also patrol them to increase the chances of successful execution. Clear boundaries give people the space they need to think, organize, experiment, and reflect. Recognizing this, Sougarret would not allow the families and the press to interact with the rescue team directly but personally updated them every day, with the assistance of René Aguilar, a risk expert from Codelco with a degree in psychology. As more and more family members continued to arrive, Aguilar helped them cope with their fears at a tent city that sprang up a short distance away, Campamento Esperanza (Camp Hope). "We wanted the drillers, engineers, and geologists to drill and work without any noise and distraction," he explains.

Sougarret, Aguilar, and mining minister Golborne, who was a regular visitor at San José, worked hard to inspire the technical team as it coped with frequent failure and painfully little daily progress. They offered support and regularly emphasized the mission's urgency. Whenever members of the rescue effort hit roadblocks, the leaders shifted seamlessly to sustaining their involvement and motivating them. They created a psychologically safe environment, never blaming anyone and always focusing on the learning generated by failure. "It was a high-pressure environment. When someone looked low, we would ask: 'Hey, are you OK? Is your family OK? Why don't you take a rest?' These are small things, but they helped create a sense that we were there for each other," recalls Aguilar.

Engage

Direct Execution and Enable Innovation

Engagement is about action, diving in, doing the work. In ambiguous and dynamic environments, leaders drive that process through an unusual mix of disciplined execution and rapid innovation.

At the San José mine, the depth and size of the refuge made locating it staggeringly difficult. Boring down to a target 2,300 feet deep with even a 5% margin of error implied that drills could end up anywhere in a base area of over 40,000 square feet. As the refuge was about 530 square feet in size, the chance that any given drill hole would find it was a little over 1.25%, or about one chance in 80. The poor quality of available maps of the mine tunnels further reduced the odds. Even if the team drilled multiple boreholes, the shot-in-the-dark strategy was unlikely to succeed.

To maximize the chances of success, several teams worked independently to come up with different drilling plans, as mentioned earlier. Though many drilling attempts failed, they yielded crucial information about the mine and the rock. For instance, the drillers discovered that the fallen rock had trapped water and sedimentary rocks, which increased drill deviations. That would make it even more difficult to find the refuge in time.

One innovation restored hope. Miners usually measure results after they finish drilling holes and reach the targeted depth. At the suggestion of the team leaders, the drillers at San José started taking measurements every few hours, abandoning holes that seemed to deviate too much and quickly starting over again -- discouraging as that was. The short action-assessment cycles minimized the time and resources spent pursuing fruitless paths and allowed corrections in almost real time.

Frequent measurements revealed the patterns of deviation in boreholes that occurred as the rescue teams drilled down at an angle. (Drilling straight down was avoided to prevent another cave-in.) To reach the refuge, drillers would have to start in a direction quite different from its estimated location and account for the inescapable but difficult-to-project curve revealed by real-time drill profile data. Drillers incorporated these technical data constantly into their plans, updating them more than once every day.

To facilitate engagement, Sougarret used an organizational design that combined centralized and decentralized components. Daily communications with families and the press and morning updates among the technical heads were tightly controlled affairs. Technical subgroup leaders, who met every morning, used a strict communications protocol to handle the transition between the day and night shifts and to conduct routine maintenance. At the same time, they were allowed to independently design and conduct any tests they wished.

Rather than creating a schedule in advance, Sougarret called short meetings as needed, especially to hold postmortems on failed tests or efforts. In the operation's complex and fast-changing context, it was essential to balance an assessment of the big picture with an awareness of details that just might matter. Although Sougarret personally executed few of the tactical steps, our interviews uncovered several instances where his skillful inquiry generated innovation by pushing thinking deeper and connecting it with the larger picture.

Sougarret encouraged the team to do things quickly. Failure was inevitable; the key was to fail fast and learn fast, executing multiple ideas at once -- not sequentially -- because time was the scarcest resource. He kept pushing people to figure out what each misstep could teach the organization and put fresh insights into practice as the next effort got under way.

Tolerance for imperfect execution is essential in dynamic situations. Few new ideas can be executed flawlessly the first time around. However, tolerance does not mean being undemanding; leaders need to create the psychological safety to learn but integrate it with accountability and motivate people to do their best.

After 17 days of drilling, the team finally discovered the trapped miners. On August 22, the eighth borehole reached a ramp in the mine about 66 feet from the shelter. For days, the trapped miners had heard drills nearing and prepared notes, which they taped to the drill tip when it broke through. Up top, the drilling engineers thought they heard something, but even they were surprised to find the notes when they pulled out the drill bit, three hours later. "Estamos bien en el refugio, los 33" ("We are well in the shelter, the 33"), said one written on a piece of paper in red marker.

Over the next 52 days, three teams worked in parallel to extract the miners. Plan A, a slow option, used the massive Australian-built Strata 950 rig to drill and widen a circular hole. Plan B used cluster hammer technology from an American company, Center Rock, to widen existing boreholes to accommodate a rescue capsule. Plan C drilled a wide escape shaft in a single pass, with a powerful oil rig operated by the Canadian company Precision Drilling, but repeatedly suffered course deviations owing to the hardness of the rock. Meanwhile, the Chilean Navy and NASA worked on building a steel rescue capsule with retractable wheels.

When the team using Plan B finally broke through to the refuge, on October 9, Plan A had drilled 85% of the required depth and Plan C, 62%. Four days later the last of the 33 miners would be hoisted to the surface in the rescue capsule and reunited with his family.

A Shifting Focus

Executives leading change efforts usually tackle the three key tasks in a logical progression, first envisioning the future, then enrolling change agents, and last engaging in the work of change. This linear flow falls short in dynamic environments. Because engagement brings frequent bursts of crucial new knowledge, constant reenvisioning is essential. The reshaped reality calls for new paths to success and often changes who needs to be enrolled in the effort.

For instance, at Pixar, a company that routinely faces ambiguity and tight deadlines, learning and execution are intertwined in the production process. An initial vision is executed on storyboards, but daily meetings lead to frequent deviation, experimentation, debate, and learning that result in a new vision. Periodically, as Bill Capodagli and Lynn Jackson point out in their book *Innovate the Pixar Way*, the team reaches out to enroll a "brain trust" -- a flexible group of directors and experts -- to get additional input.

Envisioning, enrolling, and engaging thus constitute overlapping leadership tasks. Changes in any one task will necessitate changes in the other two, so work on all three will coevolve over the course of the effort. This means companies must shift from an orderly and sequential process to a dynamic, iterative one.

Since no one really knows how the process will unfold, the need for rapid learning is central. When Phil Bernstein, a senior executive at the software company Autodesk, wanted to build a striking new corporate headquarters outside Boston against a demanding deadline, he turned to integrated project delivery, a radical process innovation in the construction industry. It requires all project stakeholders to work as a team from the outset, exchanging ideas, identifying solutions, and even sharing profits and losses. Few knew how the new process would evolve. However, Bernstein's team learned from its day-to-day mistakes, corrected course rapidly, and delivered an award-winning building on time and on budget.

It isn't easy for leaders to make the shift to an iterative process; most cultures and systems will stifle their attempts. Among the obstacles are the unfamiliarity of new norms and behaviors and the weight of existing processes. Executives will have to shed the deeply embedded beliefs that important business challenges and opportunities are well defined, are technical in nature, and yield to the disciplined application of expertise, and that quarterly performance measures are the right way to assess how well they've been addressed. Today's threats and opportunities are increasingly ambiguous and changeable and require far more fluid, creative teamwork. They require leaders who can direct and empower at the same time. That doesn't mean sending mixed messages but, rather, entails communicating explicitly that the demands of the environment call for both execution and innovation.

Executives have to overcome their reliance on a single approach to leadership. They're not immune to the hammer-and-nail problem, and approaches that have worked in the past are often irresistible even if the present bears little resemblance to it. A desire to do something, even when it is not clear what to do, is strong. In fast-changing environments, it is easy for leaders to overinvest in doing and underinvest in reflecting on alternative possibilities.

In such environments, failure is evidence that a task has yet to be mastered, but recurrent failure, coupled with high stress, is difficult to confront. As soon as leaders start ignoring data that don't support their assumptions, the process of making adjustments stalls. Leaders must develop a healthy tolerance for failure and ambiguity in order to use the dual approach to leadership effectively.

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THAT'S IT, PARKINSON, BIDE YOUR TIME JUST WAIT TILL YOU'RE IN THE DOOR, THEN HIT 'EM WITH YOUR PITCH

PHOTO (BLACK & WHITE)

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### A Search and Rescue Timeline

#### Day 1

#### Accident

Mine caves in on August 5, 2010



President Piñera with the miners' note



**Day 17****Discovery**

A drill reaches the 33 missing miners, who are alive in a shelter

**Day 26****PLAN A**

**PLAN A** One rescue team starts drilling a new escape hole

**Day 31****PLAN B**

**PLAN B** A second team begins widening an existing borehole



*Leaders confer at the rescue hole*

**Day 45****PLAN C**

**PLAN C** A third team starts using an oil rig to drill a wider escape shaft

**Day 50****STILL TRAPPED**

Miners have survived underground longer than anyone else in history

**PLAN A** Halted

**PLAN B** Succeeds

**PLAN C** Halted

**Day 65****BREAKTHROUGH TO SHELTER**

*Alex Vega, the 10th miner to reach the surface*

**Day 68-69****RESCUE** October 12-13**The Dual Imperatives of High-Stakes Leadership**

In time-pressured, make-or-break situations, leaders need to take a two-pronged approach, giving their teams clear direction and, at the same time, enabling rapid innovation. To implement the approach, they must perform three tasks, which encompass both kinds of activities.

Direct Enable Envision Realistically assess the current situation and how it's likely to evolve Articulate the possibility of hope against all odds Enroll Set boundaries for who will be on the team and motivate them to address the problem Reach out to collaborate with diverse experts Engage Lead disciplined, coordinated execution Invite innovation through experimentation and learning The depth and size of the miners' refuge made locating it staggeringly difficult. The chance that any given drill hole would hit it was a little over 1.25%.

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