Speeding Up Team Learning

The most successful teams adapt quickly to new ways of working. Now, a study of 16 cardiac surgery teams offers intriguing insights on how to make that happen.

by Amy Edmondson, Richard Bohmer, and Gary Pisano

CARDIAC SURGERY is one of medicine's modern miracles. In an operating room no larger than many household kitchens, a patient is rendered functionally dead – the heart no longer beating, the lungs no longer breathing – while a surgical team repairs or replaces damaged arteries or valves. A week later, the patient walks out of the hospital.

The miracle is a testament to medical technology – but also to incredible teamwork. A cardiac surgical team includes an array of specialists who need to work in close cooperation for the operation to succeed. A single error, miscommunication, or slow response can have disastrous consequences. In other words, surgical teams are not all that different from the cross-functional teams that in recent years have become crucial to business success.

We studied how surgical teams at 16 major medical centers implemented a difficult new procedure for performing cardiac surgery. What we found sheds light on one of the key determinants of team performance: a team's ability to adapt to a new way of working. In corporate settings, teams frequently have to learn new technologies or processes that are designed to improve performance. Often, however, things get worse – sometimes for a long time – before they get better. Team members may find it hard to break out of deeply ingrained routines. Or they may struggle to adjust to new roles and communication requirements.

When a product development team adopts computer-aided design tools, for example, designers, test engineers, process engineers, and even marketers have to learn the technology. But they also have to create and become comfortable with entirely new relationships, working collaboratively instead of making contributions individually and then handing pieces of the project off to the next person.

Most teams become proficient at new tasks or processes over time. But time is a luxury few teams – or companies – have. If you move too slowly, you may find that competitors are reaping the benefits of a new technology while you're still in the learning stages or that an even newer technology has superseded the one you're finally integrating into your work. The challenge of team management these days is not simply to execute existing processes efficiently. It's to implement new processes – as quickly as possible.

Whether in a hospital or an office park, getting a team up to speed isn't easy. As a surgeon on one of the teams

we studied wryly put it, the new surgical procedure represented "a transfer of pain – from the patient to the surgeon." But if that came as no surprise, we *were* surprised at some of the things that helped, or didn't help, certain teams learn faster than others. An overriding lesson was that the most successful teams had leaders who actively managed their teams' learning efforts. That finding is likely to pose a challenge in many areas of business where, as in medicine, team leaders are chosen more for their technical expertise than for their management skills.

Teamwork in Operation

A conventional cardiac operation, which typically lasts two to four hours, unites four professions and a battery of specialized equipment in a carefully choreographed routine. The surgeon and the surgeon's assistant are supported by a scrub nurse, a cardiac anesthesiologist, and a perfusionist – a technician who runs the bypass machine that takes over the functions of the heart and lungs. A team in a typical cardiac surgery department performs hundreds of open-heart operations a year. Consequently, the well-defined sequence of individual tasks that constitute an operation becomes so routine that team members often don't need words to signal the start of a new stage in the procedure; a mere look is enough.

Open-heart surgery has saved countless lives, but its invasiveness – the surgeon must cut open the patient's chest and split the breastbone – has meant a painful and lengthy recovery. Recently, however, a new technology has enabled surgical teams to perform "minimally invasive cardiac surgery" in which the surgeon works through a relatively small incision between the ribs. The procedure, introduced in hospitals in the late 1990s, held out the promise of a much shorter and more pleasant recovery for thousands of patients – and a potential competitive advantage for the hospitals that adopted it. (For a description of the procedure, see the sidebar "A New Way to Mend a Broken Heart.")

Although the scene and players remain the same, the new technology significantly alters the nature of the surgical team's work. Obviously, individual team members need to learn new tasks. The surgeon, with the heart no longer laid out in full view, has to operate without the visual and tactile cues that typically guide this painstaking work. The anesthesiologist has to use ultrasound imaging equipment, never before a part of cardiac operations. But the mastery of new tasks isn't the only challenge. In the

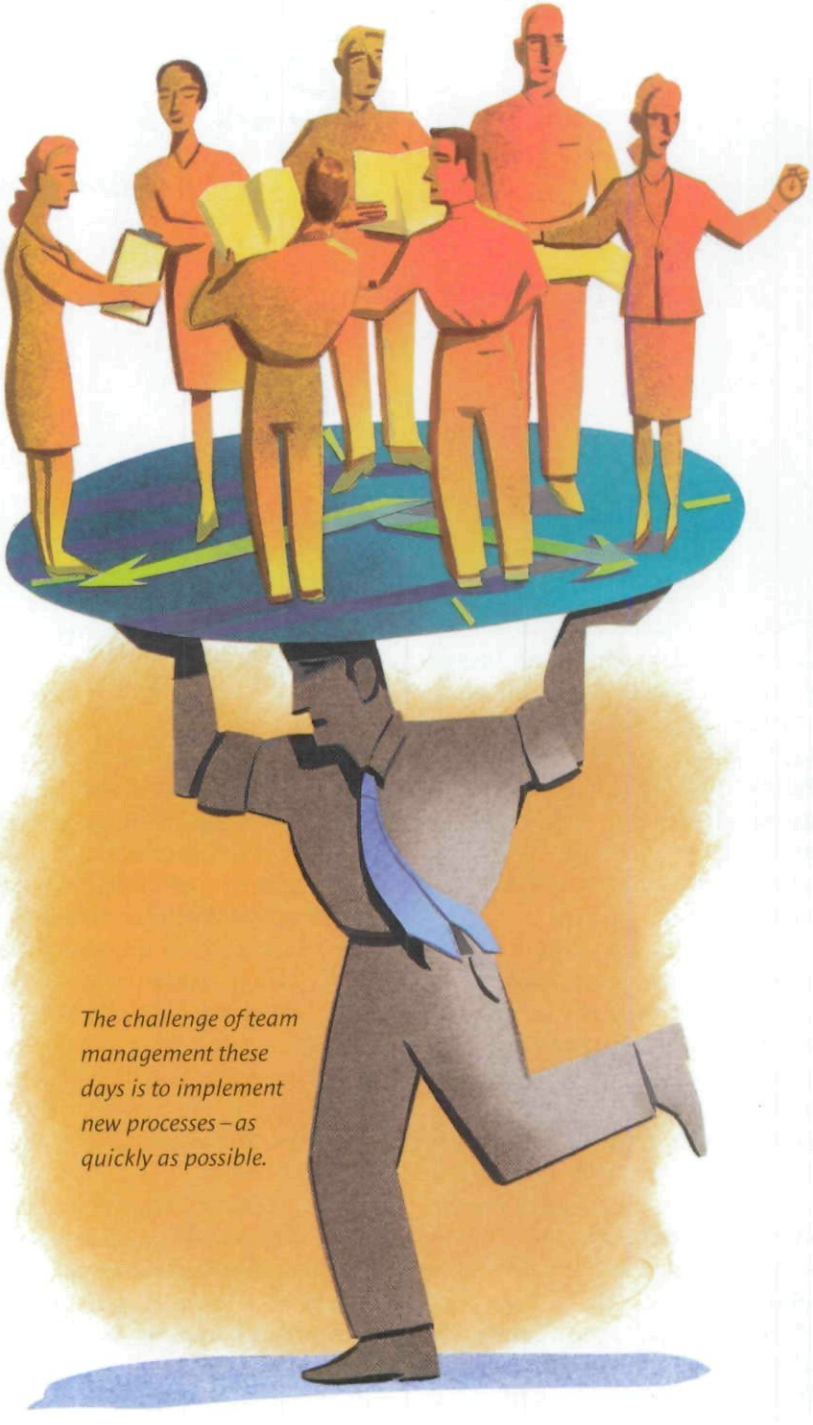

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ILLUSTRATION: KATHERINE MAHONEY

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A New Way to Mend a Broken Heart

The cardiac surgery technology we studied is a modification of conventional cardiac surgery, but it requires the surgical team to take a radical new approach to working together.

The standard cardiac operation has three major phases: opening the chest, stopping the heart, and placing the patient on a heart-lung bypass machine; repairing or replacing damaged coronary arteries or valves; and weaning the patient from bypass and closing the chest wound. The minimally invasive technology, adopted by more than 100 hospitals beginning in the late 1990s, provides an alternative way to gain access to the heart. Instead of cutting through the breastbone, the surgeon uses special equipment to work on the heart through an incision between the ribs.

The small size of the incision changes open-heart surgery in several ways. For one thing, the surgeon has to operate in a severely restricted space. For another, the tubes that connect the patient to the bypass machine must be threaded through an artery and vein in the groin instead of being inserted directly into the heart through the incision. And a tiny catheter with a deflated balloon must be threaded into the aorta, the body's main artery, and the balloon inflated to act as an internal clamp. In conventional cardiac surgery, the aorta is blocked off with external clamps inserted into the open chest.

The placement of the internal clamp is an example of the greater coordination among team members required by the new procedure. Using ultrasound, the anesthesiologist works carefully with the surgeon to monitor the path of the balloon as it is inserted, because the surgeon can't see or feel the catheter. Correct placement is crucial, and the tolerances on balloon location are extremely low. Once the balloon clamp is in position, team members, including the nurse and the perfusionist, must monitor it to be sure it stays in place.

"The pressures have to be monitored on the balloon constantly," said one nurse we interviewed. "The communication with perfusion is critical. When I read the training manual, I couldn't believe it. It was so different from standard cases."

Perhaps it isn't surprising that adoption of the procedure – by all of the teams – took longer than expected. The company that developed the technology estimated that it would take surgical teams about eight operations before they were able to perform the new procedure in the same amount of time as conventional surgery. But for even the fastest-learning teams in our study, the number was closer to 40.

new procedure, a number of familiar tasks occur in a different sequence, requiring a team to unlearn the old routine before learning the new one.

More subtly, the new technology requires greater interdependence and communication among team members. For example, much of the information about the patient's heart that the surgeon traditionally gleaned through sight and touch is now delivered via digital readouts and ultrasound images displayed on monitors out of his or her field of vision. Thus the surgeon must rely on team members for essential information, disrupting not only the team's routine but also the surgeon's role as order giver in the operating room's tightly structured hierarchy.

Isolating the "Fast Factors"

The 16 teams we studied were among those that adopted this demanding new procedure. Given its complexity, they exercised great care in carrying it out, checking and double-checking every step. As a result, the rate of deaths and serious complications was no higher than for conventional procedures. But the teams were taking too long. At every hospital we studied, operations using the new technology initially took two to three times longer than conventional open-heart procedures.

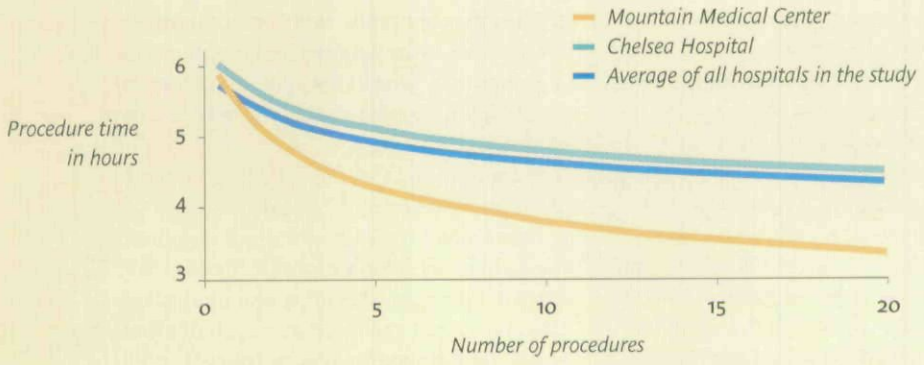
Time is important in cardiac surgery. Long operations put patients at risk and strain operating teams, both mentally and physically. And with operating-room time costly and profit margins for cardiac surgery relatively high, cash-strapped hospitals want to maximize the number of operations cardiac teams perform daily.

As teams at the various hospitals struggled with the new procedure, they did get faster. This underscored one of the key tenets of learning, that the more you do something, the better you get at it. But a striking fact emerged from our research: The pace of improvement differed dramatically from team to team. Our goal was to find out what allowed certain teams to extract disproportionate amounts of learning from each increment of experience and thereby learn more quickly than their counterparts at other hospitals.

A Tale of Two Hospitals

The leader of the team implementing the minimally invasive surgical procedure at Chelsea Hospital was a renowned cardiac surgeon who had significant experience with the new technology. Despite that apparent advantage, his team learned the new procedure more slowly than the teams at many other hospitals, including Mountain Medical Center, where the team leader was a relatively junior surgeon with an interest in trying new techniques. Why?

The New Technology as a Plug-in Component. Chelsea Hospital (the names of the hospitals are pseudonyms) is an urban academic medical center that at the time of our study had just hired a new chief of cardiac surgery. He seemed an ideal choice to lead the department's adoption of the new technology, as he had used the new procedure in numerous operations at another hospital (one that was not in our sample). Administrators at Chelsea supported the surgeon's request to invest in the new technology and agreed to send a team to the supplier company's formal training program.



Procedure times have been adjusted for the type of operation and the severity of the patient's illness. The curves are trend lines that reflect the average improvement in procedure times.

The surgeon, however, played no role in selecting the team, which was assembled according to seniority. He also didn't participate in the team's dry run prior to the first case. He later explained that he didn't see the technique as particularly challenging, having experimented for years with placing a balloon in the aorta. Consequently, he explained, "it was not a matter of training myself. It was a matter of training the team." Such training, though, wouldn't require a change in his style of communicating with the team, he said: "Once I get the team set up, I never look up [from the operating field]. It's they who have to make sure that everything is flowing."

Mastering the new technology proved unexpectedly difficult for all team members. After almost 50 cases at Chelsea, the surgeon said: "It doesn't seem to be getting that much better. We're a little slicker, but not as slick as I would like to be." As at other sites, team members at Chelsea reported being amazed by the extent to which the procedure imposed a need for a new style and level of communication. But they were less confident than team members at other hospitals that they would be able to put these into practice.

The New Technology as a Team Innovation Project. Mountain Medical Center is a respected community hospital serving a small city and the surrounding rural area. Although the cardiac surgery department didn't have a history of undertaking major research or cardiac surgical innovation, it had recently hired a young surgeon who took an interest in the new procedure. More than any of the team leaders at other hospitals, this surgeon recognized that implementing the technology would require the team to adopt a very different style. "The ability of the surgeon to allow himself to become a partner, not a dictator, is critical," he said. "For example, you really do have to change what you're doing [during an operation] based on a suggestion from someone else on the team. This is a complete restructuring of the [operating room] and how it works."

Team members, who were picked by the surgeon based on their experience working together, responded enthusiastically to his approach. One noted that the "hierarchy [has] changed," creating a "free and open environment with input from everybody." Said another: "I'm so excited about [the new procedure]. It has been a model, not just for this hospital but for cardiac surgery. It is about what a group of people can do." He explained that the team got better because "the surgeon said, 'Hey, you guys have got to make this thing work.' That's a great motivator."

In the end, despite the team leader's modest reputation and the hospital's limited experience in implementing new cardiac procedures, Mountain Medical was one of the two hospitals in our study that learned the new technology most quickly.

The adoption of the new technology provided an ideal laboratory for rigorously studying how teams learn and why some learn faster than others. We collected detailed data on 660 patients who underwent minimally invasive cardiac surgery at the 16 medical centers, beginning with each team's first such operation. We also interviewed in person all staff members who were involved in adopting the technology. Then we used standard statistical methods to analyze how quickly procedure times fell with accumulated experience, adjusting for variables that might influence operating time, such as the type of operation and the patient's condition. Using these and other data, we also assessed the technology implementation effort at each hospital.

Because teams doing conventional cardiac surgery follow widely accepted protocols and use standardized technology, the teams adopting the new procedure started with a common set of practices and norms. They also received the same three-day training program in the new technology. This consistency among teams in both their traditional work practices and their preparation for the new task helped us zero in on the "fast factors" that allowed some teams to adopt the technology relatively quickly.

Rethinking Conventional Wisdom

We were surprised by some of the factors that turned out not to matter in how quickly teams learned. For instance, variations among the teams in educational background and surgical experience didn't necessarily have any impact on the steepness of the learning curve. (For a comparison of teams at two medical centers, see the sidebar "A Tale of Two Hospitals.")

We also turned up evidence that countered several cherished notions about the ways organizations – and, by implication, teams – adopt new technologies and processes. For one thing, high-level management support for the minimally invasive technology wasn't decisive in hospitals' success in implementing it. At some hospitals, implementation was unsuccessful despite strong vocal and financial support from senior officials. At others, teams enjoyed tremendous success despite support that was ambivalent at best. For example, one surgeon initially had difficulty convincing hospital administrators that the new procedure should be tried there; they saw it as a time-consuming distraction that might benefit surgeons but would further tax the overworked hospital staff. Even so, the surgeon's team became one of the more successful in our study.

The status of the surgeon who led the team also didn't seem to make a difference. Conventional wisdom holds that a team charged with implementing a new technology or process needs a leader who has clout within the organization – someone who can "make things happen" in support of the team's efforts.

But we saw situations in which department heads and world-renowned cardiac surgeons couldn't get their teams to adapt to the new operating routine. At other sites, relatively junior surgeons championed the new technology and, with little support from more senior colleagues, brought their teams quickly along the learning curve.

Finally, the debriefs, project audits, and after-action reports so often cited as key to learning weren't pivotal to the success or failure of the teams we studied. In fact, few surgical teams had time for regular, formal reviews of their work. At one hospital, such reviews were normally conducted at midnight over take-out Chinese food. Some research-oriented academic medical centers did aggregate performance data and analyze the data retrospectively, but teams at these hospitals didn't necessarily improve at faster rates. Instead, as we will discuss, the successful teams engaged in real-time learning – analyzing and drawing lessons from the process while it was under way.

Creating a Learning Team

We found that success in learning came down to the way teams were put together and how they drew on their experiences – in other words, on the teams' design and management. Teams that learned the new procedure most quickly shared three essential characteristics. They were designed for learning; their leaders framed the challenge in such a way that team members were highly motivated to learn; and the leaders' behavior created an environment of psychological safety that fostered communication and innovation.

Designing a Team for Learning. Team leaders often have considerable discretion in determining, through choice of members, the group's mix of skills and areas of expertise. The teams in our study had no such leeway – cardiac surgery requires a surgeon, an anesthesiologist, a perfusionist, and a scrub nurse. But the leaders who capitalized on the opportunity to choose particular individuals from those specialties reaped significant benefits.

At one extreme, the leaders – the surgeons – took little initiative in choosing team members. At one hospital, the staff members chosen for training in the procedure were, essentially, those who happened to be available the weekend of the training session.

In a few teams, however, selection was much more collaborative, and the choices were carefully weighed. An anesthesiology department head, for instance, might get significant input from the cardiac surgeon before choosing an anesthesiologist. Selection was based not only on competence but also on such factors as the individual's ability to work with others, willingness to deal with new and ambiguous situations, and confidence in offering suggestions to team members with higher status.

Another critical aspect of team design was the degree to which substitutions were permitted. In conventional surgery, all members of the surgical department are assumed to be equally capable of doing the work of their particular discipline, and team members within a discipline are readily substituted for one another. It's logical to assume that training additional team members would allow for more cases to be performed using the new procedure, but we found that such flexibility has a cost. Reductions in average procedure time (adjusted for patient complexity) were faster at hospitals that kept the original teams intact.

At one hospital where several additional members of the nursing, anesthesiology, and perfusion staff were trained in the new procedure shortly after adoption, the makeup of the team changed with almost every operation. Again and again, teams had to learn from scratch how to work together. After the tenth time, the surgeon demanded a fixed team whenever he performed the new procedure. Operations went more smoothly after that.

Framing the Challenge. When discussing the new procedure with team members, the leaders of teams that successfully implemented the new technology characterized adopting it as an organizational challenge rather than a technical one. They emphasized the importance of creating new ways of working together over simply acquiring new individual skills. They made it clear that this reinvention of working relationships would require the contribution of every team member.

By all accounts, the difficulty of the new procedure makes cardiac surgery even more stressful than usual, at least initially. But many surgeons didn't acknowledge the higher level of stress or help their teams internalize the rationale for taking on this significant new challenge. Instead, they portrayed the technology as a plug-in component in an otherwise unchanged procedure. As one surgeon told us: "I don't see what's really new here. All the basic components of this technology have been around for years." This view led to frustration and resistance among team members. Another surgeon, who characterized the procedure as primarily a technical challenge for surgeons, was assisted by a nurse who, with grim humor, said she would rather slit her wrists than do the new procedure one more time. Her attitude was shared by many we interviewed.

But that attitude wasn't universal. At some hospitals, staff members were excited to be "part of something new," as one expressed it. A nurse reported that she felt honored to be a member of the team, in part because it was "exciting to see patients do so well." The leaders of teams with positive attitudes toward the challenge explicitly acknowledged that the task was difficult and emphasized the importance of each person's contribution. The surgeon who talked of the transfer of pain from the patient to the surgical team helped his team by highlighting, with light humor, the frustration they all faced in this learning challenge.

Creating an Environment of Psychological Safety. Teams, even more than individuals, learn through trial and error. Because of the many interactions among members, it's very difficult for teams to perform tasks smoothly the first time, despite well-designed train-

ing programs and extensive individual preparation. The fastest-learning teams in our study tried different approaches in an effort to shave time from the operation without endangering patients. Indeed, team members uniformly emphasized the importance of experimenting with new ways of doing things to improve team performance – even if some of the new ways turned out not to work.

As we have noted, this learning in action proved to be more effective than the after-action analysis so often touted as key to organizational learning. Real-time learning occasionally yielded insights that might have been lost had a team member waited for a formal review session. During a procedure at one hospital, for instance, a nurse spontaneously suggested solving a surgical problem with a long-discarded type of clamp affectionately known as the "iron intern." The use of the nearly forgotten medical device immediately became part of that team's permanent routine.

When individuals learn, the process of trial and error – propose something, try it, then accept or reject it – occurs in private. But on a team, people risk appearing ignorant or incompetent when they suggest or try something new. This is particularly true in the case of technology implementation, because new technologies often render many of the skills of current "experts" irrelevant. Neutralizing the fear of embarrassment is necessary in order to achieve the robust back-and-forth communication among team members required for real-time learning.

Teams whose members felt comfortable making suggestions, trying things that might not work, pointing out potential problems, and admitting mistakes were more successful in learning the new procedure. By contrast, when people felt uneasy acting this way, the learning process was stifled.

Although the formal training for the new procedure emphasized the need for everyone on the team to speak up with observations, concerns, and questions while using the technology, such feedback often didn't happen. One team member even reported being upbraided for pointing out what he believed to be a life-threatening situation. More typical was the comment of one nurse: "If you observe something that might be a problem, you are obligated to speak up, but you choose your time. I will work around the surgeon and go through his PA [physician's assistant] if there is a problem."

But other teams clearly did foster a sense of psychological safety. How? Through the words and actions of the surgeons who acted as team leaders – not surprising, given the explicit hierarchy of the operating room. At one hospital, the surgeon told team members that they had been selected not only because of their skills but also because of the input they could provide on the process. Another surgeon, according to one of his team members, repeatedly told the team: "I need to hear

Becoming a Learning Leader

Creating an environment conducive to team learning isn't hard, but it does require a team leader to act quickly. Social psychologists have shown that people watch their supervisors carefully for cues on how team members are expected to behave. These impressions form early in the life of a group or project. To set the right tone, team leaders must:

Be accessible. In order to make clear that others' opinions are welcomed and valued, the leader must be available, not aloof. One nurse in our study commented about a successful team leader: "He's in his office, always just two seconds away. He can always take five minutes to explain something, and he never makes you feel stupid."

Ask for input. An atmosphere of information sharing can be reinforced by an explicit request from the team leader for contributions from members. The surgeon on one successful team "told us to immediately let him know – let everyone know – if anything is out of place," said the team's perfusionist.

Serve as a "fallibility model." Team leaders can further foster a learning environment by admitting their mistakes to the team. One surgeon in our study explicitly acknowledged his shortcomings. "He'll say, 'I screwed up. My judgment was bad in that case,'" a team member reported. That signaled to others on the team that errors and concerns could be discussed without fear of punishment.

from you because I'm likely to miss things." The repetition itself was important. If they hear it only once, people tend not to hear – or believe – a message that contradicts old norms.

Leading to Learn

While our research focused on the environment of cardiac surgery, we believe our findings have implications that go well beyond the operating room. Organizations in every industry encounter challenges similar to those faced by our surgical teams. Adopting new technologies or new business processes is highly disruptive, regardless of industry. Like the surgical teams in our study, business teams that use new technology for the first time must deal with a learning curve. And the learning that takes place is not just technical. It is also organizational, with teams confronting problems similar to those encountered by the surgical teams we studied: issues of status and deeply ingrained patterns of communication and behavior.

Implementing an enterprise resource planning system, for example, involves a lot of technical work in configuring databases, setting operational parameters, and ensuring that the software runs properly on a given hardware platform. The hard part for many companies, though, is not the technical side but the fact that ERP systems completely change the dynamics – the team relationships and routines – of the organization. As our study shows, it takes time for teams to learn how decisions should be made and who should talk to whom and when. It takes even longer if people don't feel comfortable speaking up.

There's yet another parallel between business teams and surgical teams. Business teams are often led by people who have been chosen because of their technical skills or expertise in a particular area: Outstanding engineers are selected to lead product development projects, IT experts lead systems implementations, and so on. These experts often find themselves in a position similar to that of the cardiac surgeons. If their teams are to succeed, they must transform themselves from technicians into leaders who can manage teams in such a way that they become learning units.

Thus the key finding of our study – that teams learn more quickly if they are explicitly managed for learning – imposes a significant new burden on many team leaders. Besides maintaining technical expertise, they need to become adept at creating environments for learning. (See the sidebar "Becoming a Learning Leader.") This may require them – like surgeons who give up dictatorial authority so that they can function as partners on the operating teams – to shed some of the trappings of their traditional status.

The importance of a team leader's actions suggests that the executives responsible for choosing team leaders need to rethink their own approaches. For instance, if an executive views a team's challenge as purely technical, he or she is more likely to appoint a leader based solely on technical competence. In the worst (and not unfamiliar) case, this can lead to disaster; we've all known superstar technocrats with no interpersonal skills. Clearly, there is a danger in erring too far in the other direction. If team leaders are technically incompetent, they're not only liable to make bad decisions but they also lack the credibility needed to motivate a team. But senior managers need to look beyond technical competence and identify team leaders who can motivate and manage teams of disparate specialists so that they are able to learn the skills and routines needed to succeed.

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