Correcting the course of capital projects

Plan ahead to avoid time and cost overruns down the road

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At a glance

While cost overruns and delays have always been serious issues, companies have grown increasingly concerned about them.

Without close control, stakeholders may not realize the severity of delays and cost overruns.

One of the biggest missteps is starting construction before design and other project criteria are fully defined.

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Any company that has ever undertaken major capital building projects knows they almost always take longer and cost more than expected, as illustrated by Figure 1 below. In fact, when the Construction Industry Institute analyzed the performance of 975 light and heavy industrial projects in its benchmarking database, it found that only 5.4% met "best in class" predictability in terms of cost and schedule.[1]

While cost overruns and delays have always been serious issues, companies have grown increasingly concerned about them since the Great Recession and financial crisis. "Whereas poor project performance was maybe tolerated to a degree pre-global financial crisis, there's now much more scrutiny of projects as they start to exhibit any signs of performance failure," says Neil Broadhead, PwC UK partner. "Getting as much early warning as possible of projects in crisis has certainly risen up the corporate agenda."

Meanwhile, the growth in global construction spending will outpace global Gross Domestic Product (GDP) growth over the next decade, with growth in construction forecast to reach $12 trillion by 2020, according to Global Construction Perspectives and Oxford Economics.[2]

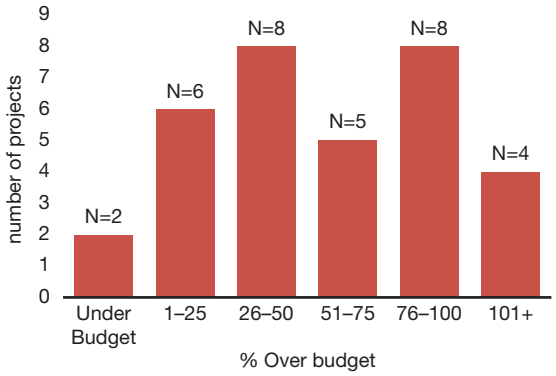
Construction projects—especially mega-projects, those typically defined as exceeding $1 billion—can suffer from many problems, ranging from optimism bias in the original estimate to poor communication to slow decision making. Many owners fail to establish the proper project management structure, monitoring procedures, and risk management processes, and as a result, they don't anticipate unforeseen events and don't build in the necessary contingency plans. Because of shortcomings in project controls, they often don't realize the severity of delays and cost overruns until well after a project has foundered.

In fact, PwC analysis of industry research has found that mega-projects often exceed their budgets by 50% or more.

Proper governance and control processes are essential for spotting problems early and getting projects back on track quickly. The more time and effort companies put in at the outset, the greater the chance they will keep projects in check throughout the construction cycle. Broadhead recommends that project owners "invest upfront in planning, organization design, and systems and processes; in getting robust budgets; in doing risk analysis around budgets and schedules; and in getting your procurement strategy right."

Figure 1: Projects under budget are the exception, not the rule

Number of projects within cost overrun categories



Source: PwC analysis, based on industry research

[1] Janice Tuchman, "CII Sees Room to Improve Industrial Project Performance," *Engineering News-Record*, August 8, 2012.

[2] Oxford Economics, *Global Construction 2020*, November 2009.

What causes cost overruns?

Projects can be saved

But even projects that veer far off track can be corrected if both the owners and contractors are amenable to working together to resolve the immediate problems and establish a more effective plan for managing and monitoring the project going forward. Sometimes that requires the intervention of an independent third party to mitigate the cost overruns and schedule delays and enhance governance and control processes.

The three key elements of the control environment are proper transparency of controls, clear accountability of responsibilities, and a meaningful audit trail of information to make sure people are performing their required roles effectively. An effective risk management process is also critical. It enables project managers to monitor risks and identify when they need to put a mitigation plan in place to actively manage them.

The project manager or contractor usually makes the call on a troubled project, but occasionally external factors such as regulatory forces or the financial markets can change and raise red flags for a project. That's what happened after the financial crisis of 2008, when a number of casino developments experienced cost overruns and came under scrutiny

by executives and financiers. The industry had to evaluate ongoing projects for viability, reconsider its traditional delivery model, and assess whether it could reallocate the cost risks that casinos typically accepted in an effort to achieve luxury and schedule performance.

The historical casino development strategy was to build them bigger and better than the last one and be the first of kind to market. If a Las Vegas hotel-casino project opened on the scheduled day, owners didn't worry much about costs. Once people started pulling the slots, the new developments generated enough revenue to pay off debt obligations. Many casino projects were likely over budget long before September 2008, but no one considered those projects troubled until the external market changed and called for enhanced reporting and controls.

Why projects veer off track

"A capital project is rarely derailed by a single problem; it usually takes a series of failed steps along the way to put a project in jeopardy," says Daryl Walcroft, PwC US Capital Projects & Infrastructure partner. "And often the blame can be spread among the owners, designers, and building contractors." He explains that owners can be unrealistic in their expectations; contractors, misleading in their progress reports; and architects, prone to errors and delays in their designs. Further complicating matters, they all may fail to communicate effectively.

While all projects are susceptible to going off track, some are more vulnerable, such as those involving new technologies, those dependent on regulatory decisions, and those in politically unstable regions. Also, large projects are inherently risky, with some exceeding $1 billion over many years and encompassing many moving parts, resources, and contractors. And in new markets, project developers face special problems, including language barriers in contract negotiations, different legal standards, a greater likelihood of political interference, and the need to import skilled labor, equipment, and materials.

Getting off on the wrong foot

Regardless of the location, however, many projects experience problems along the way because they didn't get off to a good start. There could be ill-defined cost and schedule estimates, as well as a failure to define the scope clearly and set reasonable expectations.

"Poor estimates during project planning and missed deadlines" are the largest contributors to project failure, according to *Insights and Trends*, PwC's 2012 global survey of project management leaders (see Figure 2). Furthermore, fewer than half (46.5%) of survey respondents say that an effective, formal process is in place to manage changes to baseline plans. "The most significant hurdle we see to keeping complex projects on budget is establishing how to estimate a complex project in the first place," adds John Elnitsky, vice president, project management and construction, at Duke Energy. "Specifically, how to estimate the effect of low-probability, high-consequence events that can dramatically change the project schedule and cost. Both the

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project team and senior management must be aligned on the risk tolerance of the company. All too often, the understanding of the risks associated with first-of-a- kind, complex projects are not well understood by all stakeholders. As a result the estimates do not meaningfully inform senior management of the ultimate potential outcomes of the project."

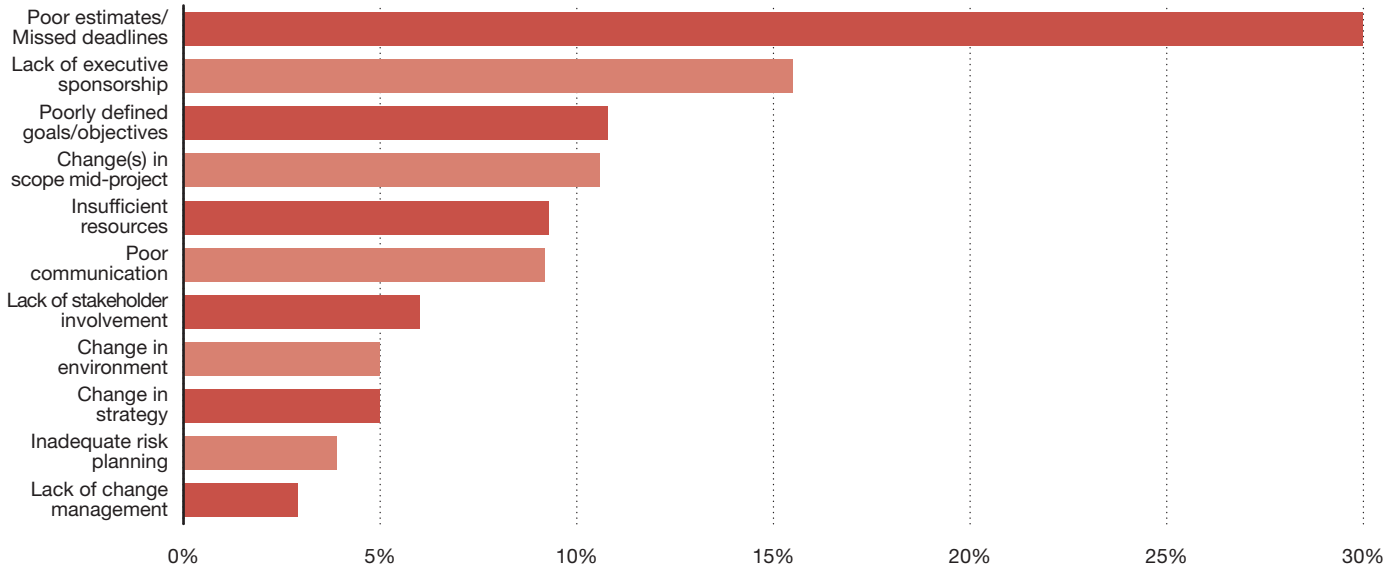
Owners may also start projects with a management team that is inadequately trained or lacks the required expertise. This issue is the heart of the matter for Elnitsky. He sees a growing talent gap in the construction and engineering fields, which can obviously mean trouble for projects. "For years, large utilities have depended on the knowledge and experience of their in-house teams. But one of the things that is happening is that the more experienced managers are starting to leave and retire," he says. "This resulting experience gap can cause issues in large project planning and oversight if not addressed."

To help avoid troubled projects, Elnitsky urges companies to focus on establishing a standard governance, oversight, and support process to facilitate project planning, development, execution and talent development. "Right now, there are a good number of managers who do not have the depth of experience to anticipate and deal with the breadth of changes and ambiguity inherent in a large, complex capital project," he says. "Success in the future requires a standard approach to project management that includes a set of standard processes and tools as well as a standard career path. Although such an approach will not ensure success on the most complex projects, it does form the basis for dealing with complexity and adversity that will arise. If we can establish a strong project management career path based on this standard approach to governance and oversight, we will help in the long run to develop seasoned managers."

Another example is provided by a steel plant in India where the owner was using its own operations people as its point management team even though they weren't aware of the kind of cost and schedule controls they should be using. And the design engineer had done project management for the company on smaller projects but not ones of such a large scale. The owner's team was merely saying, "This is where the contractors tell us they are on the project," with no challenges to their statements and no analysis of the schedule, costs, or trend indicators.

Early on, one of the biggest mistakes is starting construction before design and other project criteria are fully

Figure 2: Factors contributing to poor project performance



Source: *Insights and Trends: Current Portfolio, Program, and Project Management Practices (The third global survey on the current state of project management),* PwC, 2012.

"A capital project is rarely derailed by a single problem; it usually takes a series of failed steps along the way to put a project in jeopardy" Daryl Walcroft, PwC US Capital Projects & Infrastructure partner

defined. That leads to inevitable change orders and difficulties in facilitating various elements of design. An oil refinery project, for example, had some major mistakes in its preliminary design, and the owners had to go back to the drawing board because when the equipment arrived, it didn't fit into the allocated space. The initial budget of $500 million swelled to $1.2 billion.

Similarly, the full project team should be in place before the projects gets under way. PwC has seen this situation plague projects. "It doesn't work when people are trying to do the work and figure out the schedule and fill in the resource gaps along the way," says Walcroft. "Better to have your core team in place before moving forward."

No input from final users

In the health care industry, projects can encounter problems if they proceed without input from doctors and nurses, the key users of the facilities. "If decisions are made by an administrative team alone, it can lead to some pretty bad situations where the scope of the project has to be changed later," says Louis Saksen, senior vice president for new Parkland construction at Parkland Health & Hospital System in Dallas. For the company's $1.27 billion Parkland Hospital building project, 800 faculty members and clinical staff at the academic medical center went through mock-up rooms rather than simply look at architectural drawings, which can be difficult for a layperson to read. For example, the trauma team checked out the elevator going from the helipad on the roof to the emergency room to ensure before it was installed that it was large enough to accommodate equipment and staff.

Scheduling skills

Projects frequently encounter problems because schedule management didn't receive adequate attention. If the schedule process isn't formal and structured, multiple contractors could be managing schedules and providing the owners with schedules in different forms. Furthermore, there may not be a mechanism in place to validate that the level of progress being reported actually reflects what's happening on the construction site.

Schedule management also should be dynamic, allowing for changes in the timing of activities and taking advantage of unexpected opportunities for greater efficiency. Many companies don't place sufficient emphasis on the schedule management discipline and don't really understand that schedule planning is a specialized skill set that's hard to come by. They should be seeking people who not only are very competent with scheduling software but also bring industry experience that has taught them how to break down the scope of work and understand the approaches to planning and scheduling.

While schedule management is always critical, the schedule can become too dominant, causing some projects to run into trouble because time becomes the overriding consideration. A strong go-to-market strategy can cause schedule to be the driving force and lead to an imbalance in project objectives and severe cost overruns. Getting to market so quickly may not justify the extra spending.

Ambiguous contracts

Ambiguity in contract terms and conditions can also derail projects. To provide transparency and accountability, contract provisions should clearly delineate the roles and responsibilities of the various parties and identify the governance structure, including the execution, oversight, and assurance roles.

If the execution and oversight roles get blurred, projects become more vulnerable to scope growth. In some troubled projects, the owner abdicates the responsibility of oversight to the contractor, but they have different goals. The owner wants to complete the capital project as close to on time and on budget as possible. The contractor is motivated by profits, which increase if the scope of the project grows. Having reasonable oversight by the owner helps avoid the unintended changes in project scope that inevitably lead to cost overrides and schedule delays.

Scope creep

Major long-term health-care projects are particularly vulnerable to "scope creep." By the time they are under way, there could be a change in demand for medical care in the area, and suddenly more beds and other facilities need to be added to the plans. That's especially an issue because of continuing high unemployment, Saksen says, as more people without insurance use emergency rooms. The Parkland Hospital project originally was intended to replace all the existing facilities, but now some buildings will be retained because of rising patient demand. That decision will keep the project on budget but will require construction of a bridge between the new hospital and the old one.

But budgets often balloon because making changes in the midst of construction is much more expensive than incorporating the features in the original design. The goal should be to make only absolutely necessary changes. Sometimes, it's better to get the initial project completed and reserve some of the enhancements for a later date and a separate contract.

But often, there's lack of transparency and control around project changes. Owners may not fully understand the impact of change orders until it's too late. For example, one CEO was startled to see how much his decision to change the lobby of a commercial building cost. What seemed to be simply a matter of rearranging the reception desk and some columns to create a more unobstructed area turned out to be a much more complex and costly change because it affected the structural integrity of the building's other floors.

The cost of projects gone awry

- A PwC analysis of six nuclear plants found an average cost overrun of 157%.
- Of 47 mega-projects analyzed by PwC, the average cost overrun was 88%.
- For a refinery project budgeted at $4 billion, the final forecast was $12 billion.
- Incorrect contracting to build ships and infrastructure led to a $2 million tax loss.
- In litigation, a project owner sought €2.4 billion in damages for a three-year delay on a turnkey, €3 billion power project.

Optimism bias

Optimism bias is another leading cause of troubled projects. When people embark on big projects, they often put on rose-colored glasses, underestimating the complexity of the task at hand and simply assuming things are going to proceed smoothly. In their zeal to get approval and funding for projects, overconfident project managers fail to address potential risks early enough in the process.

Misallocation of risk

Indeed, risk management planning can make all the difference in whether a project stays on course or not. Owners must identify risks, assign them appropriately, set up controls for their own risks, and monitor the risks they have transferred to contractors. Some projects become troubled because owners didn't properly allocate risks. Owners are sometimes tempted to transfer too much risk to contractors and end up increasing their own risk in other ways. If an owner awards a fixed-price contract and shifts the cost risks to the contractor, the contractor may choose to mitigate that risk by hiring less experienced labor or using less expensive materials, creating a quality risk for the owner.

A major energy company contracted out a facility in Africa on a fixed-price basis but eventually had to reassume the price risk by switching to a cost-reimbursable arrangement in order to keep the contractor from possibly going out of business. From the start, the company should have had a thoughtful strategy that considered the risks it was most capable of mitigating and those that the vendor could best mitigate. Instead of price, the company should have transferred other risks and put incentives around its schedule and production goals.

Costly delays

Another factor in troubled projects is slow decision making. If the authorized executive fails to sign off on a routine decision, a project can languish. Or sometimes if a decision isn't forthcoming from the owner's team, a contractor may move ahead with an inappropriate and costly solution to a problem. For example, a design question arose on an Australian building project about how to enclose a natural gas canister to meet local regulations. What was needed was an inexpensive chain-link fence, but a more costly stone enclosure was proposed and eventually built by the contractor. The owner didn't respond, so the proposal was deemed accepted. That cost overrun was caused by the owner's failure to take timely action to control or oversee the contractor's actions. The wall looks quite nice, but it is far and away more than was intended or needed.

Delaying decisions can be especially costly in the long run for process plants that produce a large revenue stream as soon as they're up and running. Some projects, such as a cement or power plant, require ordering equipment a year or two in advance of delivery. If an owner

Global construction growth is forecast to reach $12 trillion by 2020, according to Global Construction Perspectives and Oxford Economics.

agonizes too long over which contractor or vendor to select in hopes of saving a little money, it isn't cost effective in the long run. One plant construction project, for example, is taking 15 months longer than expected to complete because the design engineer was so slow in completing the procurement process.

In the hospital industry, similar delays in purchasing complex equipment can be very detrimental, too. Owners sometimes put off placing orders because they're working with doctors to try to get the latest, greatest machines. Radiologists may plead for six more months before placing an order for an MRI scanner so they can get the next model. "Unfortunately, we don't have that time to wait," says Saksen of Parkland Health & Hospital System. "That's always a challenge, getting the decision-making body to understand they have to make a decision in a timely way and stick with it."

Without the equipment and electrical panels, construction workers can't hang ceilings and pour floor slabs. The completion date ends up being extended by several months and the contractor submits a delay claim.

Inadequate communications

Communications problems are often at the root of troubled projects. There may be lack of communications between the top executives and the project management team. The project manager may warn that a project is running over budget and behind schedule, but the message may not reach the C-suite and board before problems get out of hand.

Communications also may break down between the owner's project management team and the designers and contractors. The communications failure sometimes results from fear of being the messenger of bad news. Contractors often worry about backlash if they report how far behind they might be.

Saksen says he doesn't shy away from delivering bad news. "I have to be able to deliver what some people would think is bad news on a regular basis," he says, "to keep people's eye on the ball in terms of letting them know you just can't build that much for this much money. Probably the biggest shortfall in a lot of building programs is not keeping the administration aware" of cost and scope limitations.

Cultural differences

Reluctance to report project troubles is especially common in some cultures, such as the Middle East, India, and Africa. "Clients there have very high expectations, and they do not like to hear the answer, 'No, that can't be done,' or 'I can't do that in the time available,'" says Anthony Morgan, PwC UK partner. "When that happens, they may choose somebody else." Morgan adds that this is one of the challenges suppliers can face when they do business overseas.

Because of that issue and many other differences in cultural and business practices, international projects can be much more fraught with complications that get them off track. Issues can range from the climate to the infrastructure to a different approach to negotiating contracts with vendors. For example, it's particularly important to maintain a good relationship with contractors in China, because owners might not be able to hold them to the letter of the contract in a court of law as they could in most Western nations. Project developers in China also need to be vigilant about safety issues with contractors that may

not have the same standards as US contractors. Such problems could slow a project and increase costs because a vendor might have to be replaced or to step up its safety program.

Early warning signs to watch for

The best way to get back on track fast is to be alert to red flags. Such signals mean it's time to investigate to determine whether the project is truly in trouble and if so, how to fix the problems.

Two obvious signs of project trouble are requests to expand the budget and stretch the schedule. Other indicators that a project is in peril include changing project scope, materials delays, suspicion of fraud, or quality and safety concerns. One serious injury or a string of minor injuries can indicate a need to halt the project, investigate causes, and perhaps revise risk management plans.

Numerous revisions to architectural drawings and a flurry of requests for information are among the most telling red flags. RFIs often indicate that design documents were not complete enough for contractors to understand.

Another sign of trouble is a host of change orders from the owner, which can significantly affect cost and schedule. "If a contractor signed up to a fixed price and a fixed completion date, but you continue to throw additional scope and changes at him, obviously he's going to be able to renegotiate the price and completion date," says Tony Caletka, PwC US Capital Projects & Infrastructure managing director. "That's at the heart of most projects that are in litigation: disagreement about the cost and impact of these types of changes."

Sometimes, the warning sign is simply a gut feeling. Owners may have a sense that a project is slipping off course even as they keep getting back reports that everything is going just fine. There's still doubt, even fear. Savvy owners know that projects are not as predictable as standard business operations, so monthly progress reports should show at least subtle variations as managers reassess where they are in terms of time and cost. But if they regularly show the project is on budget and on schedule, that may be a signal to investigate matters further.

The reporting process might not be robust enough, or the project management team members might be withholding data, perhaps motivated by their imminent annual appraisal and their desire to show things on time and on budget. It also could be a matter of corporate culture, where people want to report that everything is on track even if that is not the case.

Comparing actual specific costs to budgeted amounts can provide valuable clues. While project teams that are reluctant to report problems may keep projected total costs the same, an examination of line items may reveal that the actual costs are all above the budgeted amounts. The project team may be balancing everything out at the bottom by saying, "Oh well, we're going to get cost savings on all these other things going forward. We know we're 50% over budget on some things we've done, but we're going to make that up late in the project." That's a big red flag.

Large projects are inherently risky, with some exceeding $1 billion over many years and encompassing many moving parts, resources, and contractors.

Another red flag is a delay in responding to questions from contractors. "If an owner has a track record of not responding to questions and requests for information in a timely manner, you could see the project go off the rails," Caletka says.

Perhaps ironically, one of the early indicators of project trouble is a lack of indicators. There may be no indicators of failure because nobody has an understanding of where the project really stands. They simply don't have the techniques in place to understand the project's true status.

How to get projects back on course

The good news is that projects can be brought back in line—and sometimes even exceed original goals. There are ways to move from a position of fear and uncertainty to one of confidence and control.

1. Take a time-out to regroup.

When a project is running late, one of the most important—but difficult—things to do is stop and get all the key people together to discuss their status, the issues, and the potential solutions. "Essentially, it seems that all you're doing is adding to the delay by stopping what you're doing to talk about it," Morgan says.

But quick and decisive action is critical, of course, when projects spin out of control. Owners need to become much more proactive and less reactive going forward. The primary goal is to quickly figure out where cost and schedule overruns are coming from, what is driving them, and what the corrective options are. For example, a troubled Middle East project was turned around by having more granular and accurate forecasts that helped senior management make more informed decisions. Governance structures were also adjusted for clearer accountability, and better risk modeling tools helped the owner get a more realistic handle on the costs and schedule. "Three key things are better reporting, a more effective organizational structure, and a better appreciation and use of risk analysis to understand where threats to the project exist," says Broadhead.

2. Seek outside help.

A willingness to work with a third-party consultant or mediator is often key to getting projects back on track. A third party may be called in because internal teams aren't equipped for the scope of the work and analysis needed to develop a road map for reining in costs and schedule slippage and stabilizing the project.

Consider, for example, a hospital project in which an "error in omission" snowballed into something much bigger. The trouble started after an architect failed to include a major electrical panel in his drawings, resulting in extra work and a $75,000 hit. The contractor put in a change order, to which the owner objected that the panel should never have been omitted from the designs in the first place. The architect offered to pay the expected premium cost at that stage of the project of about 10%, or $7,500, but the owner incorrectly expected the architect to cover the full cost of the panel. Meanwhile, the contractor submitted a delay claim for $600,000.

Ultimately, with the help of a third party, the owner, contractor, and architect compromised and ironed out their differences so the project could progress. Sometimes, such discussions may get heated because reputations and profits are on the line, but failing to work things out can have serious financial consequences down the road and can lead to costly litigation.

3. Balance cost, quality, and time.

The knee-jerk response to a troubled project might be a push to cut costs or to rush to get back on schedule. But in trying to cut costs that are out of control or speed up a project that has fallen behind, quality may suffer. The end result could be a project that comes in on time and on budget but doesn't deliver the intended results. For example, the cost of maintaining a facility could be higher than expected because it wasn't built as intended.

Projects that have fallen well behind schedule and budget can be put back on track by modifying the original plans. For relatively minimal expense, the problem might be mitigated by resequencing, or changing the order in which things are done. Another lower-cost solution is scope reduction. It might make sense to abandon part of the project that has increased significantly in cost and no longer provides the same benefit originally anticipated in the project's business case. For example, on a recent underground transit project, the project manager chose to abandon additional access and stairwells to the platforms when he could not accurately determine the likely cost of tunneling that had to run under a busy intersection. The estimates ranged from $50 million to $300 million, with uncertainty related to utilities located beneath the street. Similarly, an entire residual handling building was eliminated from a recent water treatment plant upgrade in New York City due to cost overruns on the project. The change saved both time and money, although the building's absence increased future operating costs.

"De-scoping also is sometimes necessary to de-risk a project when cost certainty is required, but there are too many unknowns remaining related to incomplete design or other factors, such as subsurface conditions," Caletka says. "If you're building a nuclear power plant, there's not a lot of potential to de-scope, but if you can de-scope, it needs to be in the hopper as one of your risk and cost reduction options."

A more expensive solution is accelerating the project by adding crews and working longer hours. But with more workers comes less efficiency. Doubling the number of workers does not double productivity. With more staff, the overall quality level of the workforce typically drops. There also are more demands on supervisors' time, and logistics costs for handling more workers also increase.

4. Layer in transparency and accountability.

Some projects need multiple solutions to recover from delays and cost overruns. For instance, a steel mill project in India required more expert workers, improved planning, better integration of schedules, and stronger risk management to recoup from setbacks. "They needed risk management around relocation of a whole village of people and ways to avoid a big drop in productivity because of the monsoon season," Morgan says.

If communications problems are at the heart of the problems with a project, companies should improve the governance structure to increase oversight of the construction process. They might, for example, consider establishing an executive steering committee for the project that has a direct line to the project manager. That can help to avoid multiple layers of intermediate reporting, which can result in information not being transmitted to the top echelon or being filtered and miscommunicated. In addition, it's advisable to establish a clear reporting process, laying out the level of information that should be communicated to the executive team and the format for presenting it.

Poor planning estimates and missed deadlines are among the largest contributors to project failure, according to Insights and Trends, PwC's 2012 Global Project Management Survey of participants in 38 countries.

Owners also may need to encourage a culture of transparency if they find that people are afraid to report that a project is in trouble. They need to ensure that it's crystal clear that delivering bad news won't be held against people, but that failure to deliver the bad news in time to take corrective measures will be.

Because the temptation to make changes as a project moves along often gets a project behind schedule and over budget, owners need to get things under control by creating a system to evaluate any further changes and approve only those that are absolutely necessary. Owners also need to analyze where risks are currently allocated and what controls are in place and then try to make necessary adjustments. If the risks have been misallocated and the project is over budget, the owner's only options are to renegotiate the contract—in which case it would have to give something up to the contractor—or to implement some level of enhanced controls, separate and apart from the contract.

5. Build penalties into the process.

Owners of troubled projects should consider not only incentives for contractors, but also penalties. For example, the owner of an Australian project that was over budget and behind schedule had blown through all of its incentives. So, an advisor told the company it could change the incentives or "use the stick rather than the carrot." Reestablishing incentives was the proverbial carrot, plus there were plenty of sticks available to the project owner as long as it was willing to risk contractor default. And if the owner was open to that risk, it would need to develop a contingency plan.

Some companies take schedule preparation and monitoring away from the contractor delivering the troubled project and assign them instead to an independent third party that can do an objective analysis and provide accurate monthly status updates.

6. Seek experienced project managers.

To help fix troubled projects, owners may need to strengthen their project management team by filling in gaps or bringing in different people with greater experience. There also could be weaknesses on the contractor's side if the contractor is using a B-team and the project demands more seasoned workers.

By demonstrating leadership and bolstering the project's workforce, the owner will restore the trust of team members and overcome their fears and frustrations.

7. Maintain a comprehensive audit trail.

Of course, project owners and contractors both hope to prevent disputes and stay out of the courtroom. But litigation is always a possibility, so all parties should thoroughly document project decisions and developments. It's important not only to keep records of delays but also to note the causes

and impact in the document trail. "When you start a detailed analysis of documents, you often find that either one of the parties hasn't retained the right records or the records aren't accurate or they can't be located," Broadhead says. "You need a robust set of processes to capture the right documents to support any claim or defend any claim should a project go so badly wrong that it ends up in dispute."

In addition to retaining counsel, owners and contractors will likely also need consultants and experts on various aspects of the project. In the end, things are never black and white. Often, if the contractor thinks something's wrong, the owner thinks a different thing is wrong.

Lessons learned

Whether or not litigation and disputes develop, once a project concludes, it's time to do a debriefing of the key players and a postmortem analysis. Lessons learned should be captured and documented for both projects that struggled and ones that sailed through smoothly. Workshops should be organized to ensure that the most experienced participants provide their recommendations for areas of improvement. Then, the engineering or construction departments should take responsibility for incorporating the lessons learned into the overall project planning and development process. Finally, the internal auditing group should monitor capital programs to ensure that the lessons actually were incorporated into the process.

"A big part of what I've done my entire career is look back and say, 'Gee, this really worked well, and gee, this really didn't work at all,'" says Saksen of Parkland. On the new Parkland Hospital project, he has learned several valuable lessons. For example, all 800 bathrooms are being prefabricated and tested, a new approach for Saksen that he deems a winner that he will likely use on other large projects. "Every other hospital I ever built where we didn't have the benefit of prefab, there was probably five percent of the bathrooms that required repairs because of leaks," he says. "We're not going to have that problem on this project."

But in the future, he would modify another new approach—colocation—because of lessons learned with the Parkland project. Saksen required the architects and builders to be in the same building with him and his team. It worked well through design development, because the owner, designers, and builders could easily communicate, resulting in better estimating and higher quality. But keeping the architects away from their own office was a mistake during the development of the detailed construction documents, Saksen says. "We learned that the architects are better off in their own office" for greatest efficiency at that stage of the project.

After a project postmortem, companies may decide to avoid certain contractors or suppliers in the future, to hire people to fill skill gaps on their team, or to beef up governance, reporting, and monitoring processes. One company decided after big cost overruns on a project in the Middle East to abandon cost-reimbursable contracts and invest more time in upfront planning and design so it could award only fixed-price contracts.

Whatever the decision, Broadhead says, "You want to make sure those lessons are hard-wired into the corporate DNA for next time."

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