7 Traps to Avoid in **Capital Project Management**

Executive Summary

Do you know what a 10% productivity gain in your capital-improvement program would generate? According to results from a recent capital-project symposium and many on-site interviews with capital-project executives, the answer to this question is: "I don't know."

In a recent study conducted by Dodge Data & Analytics, together with the Construction Owners Association of America and Lean Construction Institute, 85% of leading project owners (those who own the physical asset once a project is completed) report they have projects that exceed their baseline budgets. In addition, 92% of owner's report that they have projects that were finished later than planned, and 63% said they found quality deficiencies after the project was complete.

If you fit into the "I don't know" category, you will have trouble predicting project success from one project to the next. You're also likely to have difficulty securing the adequate staffing budget to support the aggressive design and construction projects your organization is planning. In fact, you'll likely find yourself having to answer the question: "How can I do more with less?"

The bottom line for any capital-project department within an organization is the top line: enabling the mission of the organization and producing revenue and faster growth. **Let's jump in!**

You can't expect your organization to place value on something you cannot quantify. This guide will help you do just that. We will help you answer key questions, such as:

- What are the top challenges facing owners of capital programs today?
- What are the six traits of best-in-class owners that I can apply to my organization?
- How are great design and construction departments organizationally designed?
- What technology will help me improve productivity by more than 10%?
- How can I financially measure success?

01

Challenges

Top Challenges Facing Capital Projects Today

According to a recent study of nearly 200 capital project and infratructure owners, conducted by Dodge Data & Analytics, capital-project performance continues to miss expectations by exceeding original budget, schedule, and quality objectives. However, the impact is felt far beyond any single project.

The impact on strategic goals also can be extremely distracting, and damage can continue for years, through higher debt expenses, missed revenue targets, added FTEs, and the need to reduce or alter strategic initiatives.

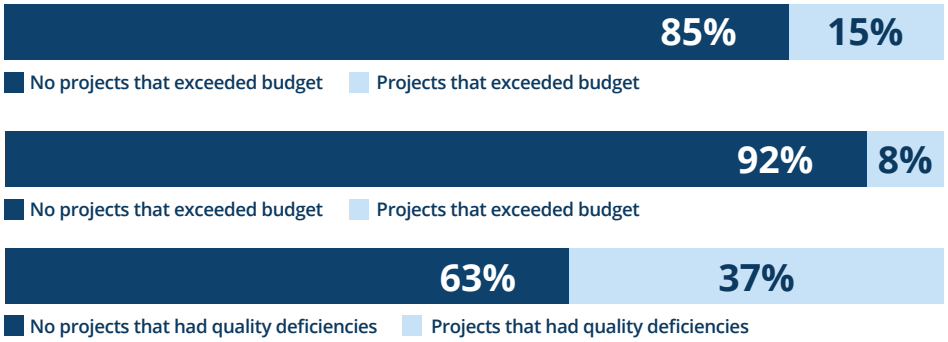
By now, we are accustomed to hearing of the immediate effects of overruns, schedule delays, design errors and omissions, and poor quality. Most often noted are the immediate financial impacts on available capital and, of course, lost margin. What is not regularly discussed are the long-term effects that these problems leave on future strategic initiatives and financial planning. This is why board members, CEOs, CFOs, and COOs should pay attention to their organizations' ability to properly plan and execute capital projects.

Capital projects must, above all else, align an organization's facilities with its strategic directions and organizational strategy. Problems often occur in the early planning stages, when good principles of due diligence and documentation aren't followed. Planning-stage problems aren't limited to cost, schedule, or quality. They open the door to misinterpreted scope, misaligned design expectations, and lack of a correlation to strategically important financial measures. A planning-stage problem can lead to inappropriate or unplanned allocation of funds, pulling dollars away from real strategic needs. In one case, a hospital vice president continually asked his project team to "tell me again how that idea helps us deliver better health care or adds to our bottom line."

A project can be successful in budget, schedule, and quality, yet fail to align with an organization's strategic plans. A project that piles up budget overruns AND fails to support strategic plans is a failure with a lasting impact.

Project performance

Percentage of respondants with projects that exceeded budget or schedule, or experienced quality deficiencies over the last three years.



7 Management Traps to Avoid

We have identified seven management traps that often catch up with project teams on failed capital projects. These traps can be substantially mitigated early in the development process.

1 **The full scope of the project is not clearly defined and documented, including the expected financial impact on business operations and strategic goals.** Design teams are forced to develop their own parameters, and with no formal guidance, they may or may not align with the organization's financial and strategic business plans. Design becomes a hit-or-miss proposition. When design teams aren't provided with clearly defined goals and supporting data, it causes them to ask stakeholders what they want vs. designing to what the data indicate they need. Operations staff often provide their "wish list," mixed in with the data, and this approach almost always leads to an over-designed, out-of-scope project. When and if it's recognized by leadership that the project's scope is out of bounds, the process of readjusting the scope can be painful.

2 **A lack of "risk-informed" program budgets leads to project staff overlooking conditions that are not intrinsic to a specific project or project type, causing unwelcome surprises during the design stage or during construction.** All too often, owners fail to include adequate funds to cover risk or the cost of risk mitigation. Scope creep and cost overruns occur late in the program, when "missed" items arise. Risk conditions are not difficult to detect during a risk assessment, and a risk analysis should include more than just design and construction operations. It should include a review of an organization's bureaucratic nature, the complexity of required permits and approvals, the reputation of authorities having jurisdiction (AHJ's), the owner's history of making quick decisions (or not), and the availability of local contractors, subcontractors, and trades, etc. Accounting for those risks during the strategic-planning phase allows for proper budgeting and management. A cost-tracking mechanism should be implemented to track "risk" dollars day-to-day.

3 **Tasks and task lists are often loosely managed at a high level (a shoot-from-the-hip methodology) without details, clear responsibilities, or delivery dates, making it difficult to manage the quality of intermediate deliverables and timing.** Dates are too often missed, with little or no consequence. Team members are often relied on to set their own tasks, schedules, and deliverables, which makes progress difficult to track and problems difficult to overcome.

4 **A lack of well-defined procedures and document-management systems cause delays in processing information, resulting in lost time and delays.** When processes and response expectations are well-defined from the beginning, and all team members are contractually obligated to perform at those levels, excuses and claims for delays drop to a minimum. If a team member isn't performing up to expectations, he or she should be identified early, before delays and damages occur. Planning, design, and construction firms are focused on maintaining their own document files, as they should, so unless the owner has a project-management information system (PMIS) in place for processing all documents, correspondence, submittals, etc., he or she is often the only team member without a comprehensive set of project data – a risky proposition should a claim arise.

5 **There is a general lack of understanding about forecasting as a management tool for documenting and budgeting potential and unfolding risks.** When managers wait until a problem is formally submitted they often go for months without accounting for a known expense. By not immediately documenting and forecasting a problem, its cost may be a surprise to finance staff when it does hit the books. A project "S-curve" for forecasting is dismissed, as some owners are not integrating cost and schedule.

6 **Project Teams often feel they can "scale up" from managing smaller projects to much larger projects by using current processes and spreadsheets.** They don't fully understand the amount and complexity of the information they are about to receive and the damage that can occur if or when they fall behind or make mistakes. Handling the onslaught of RFIs, addendums, bulletins, meetings, minutes, tasks, shop drawings, product submittals, invoices, and rejected and resubmitted data can be daunting without previous experience, strong procedures, and proper staffing levels.

7 **Internal staff are often not technically or managerially capable or don't have enough time to manage a capital project and still perform their day jobs well.** There are well-intentioned, conscientious administrative staff that we ask to behave like project manager professionals (PMP) certified project managers or cost engineers. We find internal staff often feel they can't push back on their boss, executives, other staff, and design experts without jeopardizing their careers, even when requests are questionable or don't follow the original plan. To avoid conflict, they try to make the request "fit into the program," which rarely works.

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6 Positive Traits of a Well Managed Project

There is good news, however. A case study demonstrates how a well-managed project operates under six positive traits that can be applied to any capital project.

1 Process driven

Everyone was heavily process-driven, and team members were contractually obligated to follow the designated processes.

2 Strong scope

A strong scope document was developed and provided for guidance and control prior to engaging the design team in concept or schematic designs.

3 Document control

A well-developed system of communications and document control was implemented at the beginning of the planning effort. E-mails and directives were not casually provided; they were clearly documented, then filed in the appropriate place for quick retrieval.

4 Collaborative

Project leaders encouraged and fostered a collaborative, not an antagonistic, environment. This allowed problems to be handled quickly and openly, and created an atmosphere of trust, in which everyone could find fast, collaborative solutions, not focus on fault and blame. When errors were identified, collaborative teams worked to minimize the impact on the project, which also minimized the impact on the errant team member.

5 Experienced teams

The owner's project-management teams included experienced individuals with a deep knowledge of industry, best-practice management methods, and a clear understanding of what high-quality services look like from each team member.

6 Risk assessment & forecasting

Project teams on successful projects use a form of risk assessment and forecasting to continually review potential problems, develop mitigation strategies, and forecast anticipated impact to the project. This methodology also results in a mental shift in the way managers look at a project. If you ask a successful construction superintendent about his project, you'll note how he or she thinks forward a few days or weeks at possible problems (risks) and develops ideas to keep them from occurring. Why would program managers not do the same for the entire planning, design, and construction project?

These six traits are proven to greatly increase an organization's ability to guide their own destiny. Implementing them is important to ensure successful capital programs and maintain control. In the next chapter, we'll take a look at how to make these traits part of your DNA.

02

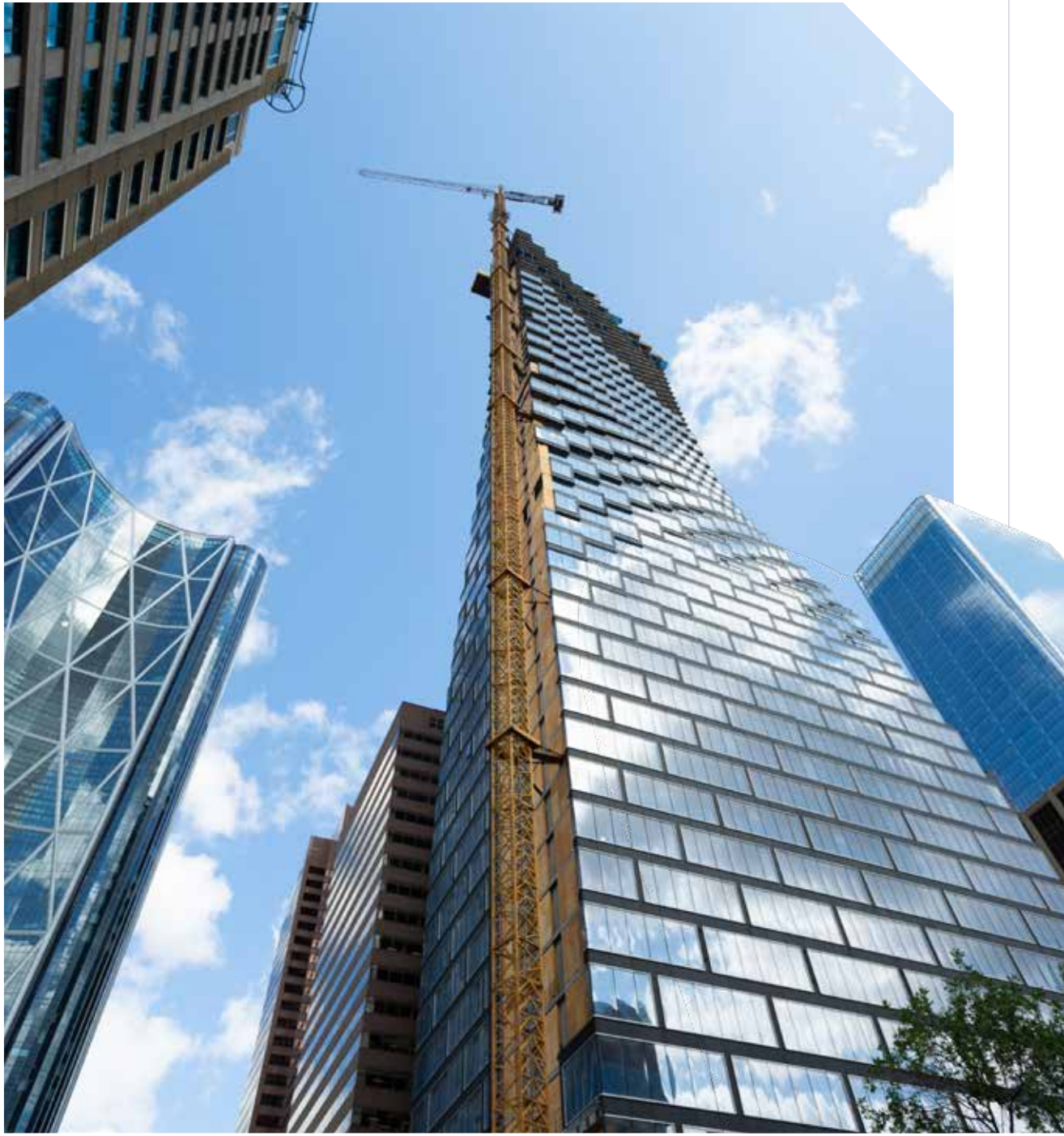
Organization Design

Organizational Design of a Best-in-Class Capital Projects Team

When acquiring or developing the traits of a successful capital-projects team, you should think in terms of three broad categories: the capabilities of each team member, the structure of the team, and the development of a strong set of project controls. Success in all these categories usually results in high-performance teams. It's important to first evaluate the task requirements necessary in developing and managing a capital project and compare those requirements to internal staff capabilities and availability. Even when staff are capable, they are often busy with their regular jobs and are unable to spend the proper amount of time on daily task requirements.

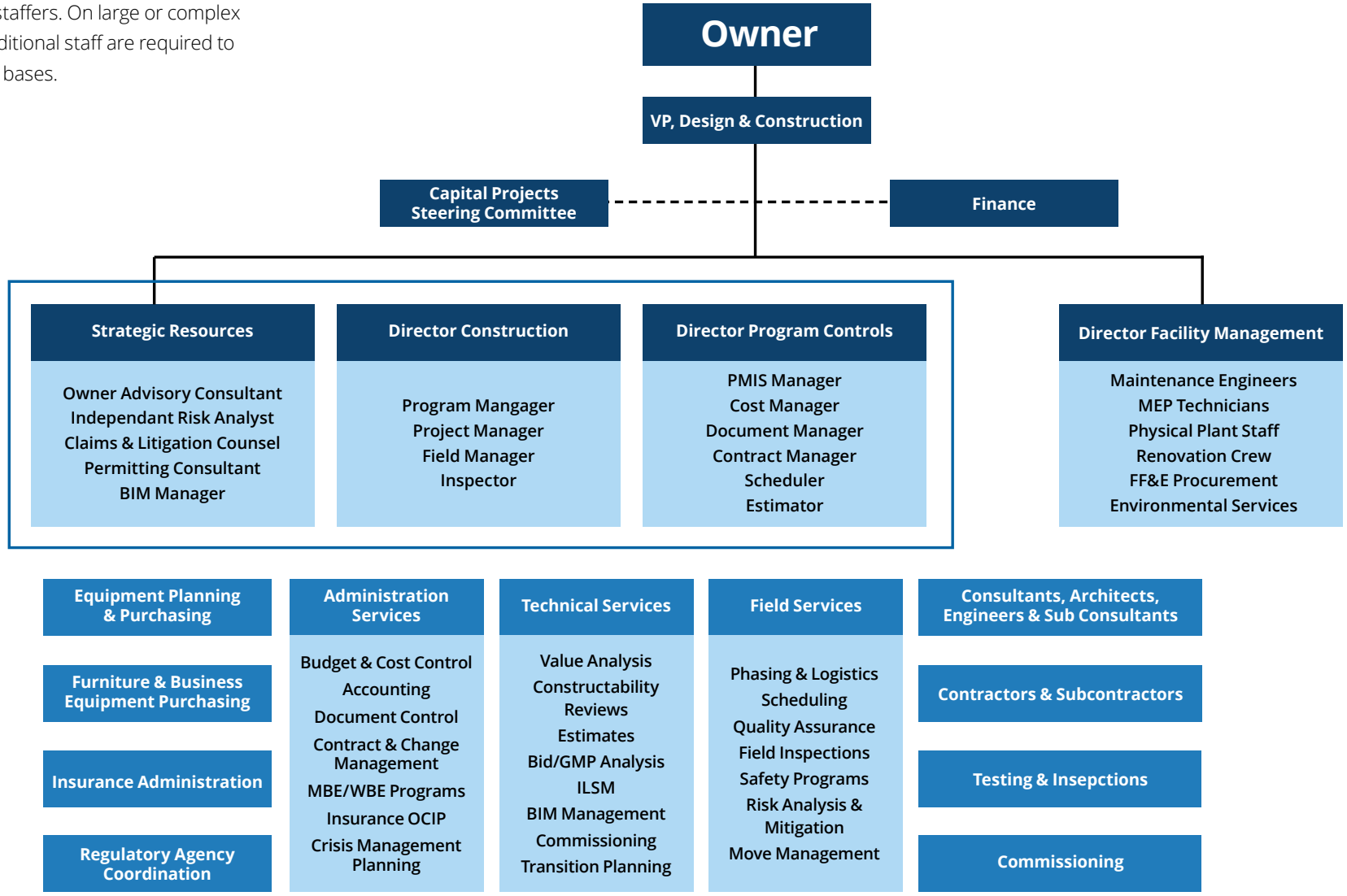
Different project types require different positions. Water/wastewater projects require certified inspectors. Hospitals and universities often negotiate "open-book" construction contracts with highly qualified firms and require technically capable project managers, but fewer inspectors.

Take time to understand your project (get help if needed), then honestly evaluate your staff, identify missing capabilities and fill in the gaps wherever necessary. Internal project managers often gain valuable experience working with an outside expert and can use that experience on your next "big job." Hoping that your staff figures it out or learns on the fly is not a good strategy.



High-performance teams should be organized around three pillars of responsibilities: 1. administrative responsibilities, 2. technical responsibilities, and 3. field responsibilities. On small or uncomplicated projects, the responsibilities may be covered by one or two staffers. On large or complex projects, additional staff are required to cover all the bases.

The chart below outlines this approach and is based on larger, more complex projects



Implementing Strong Procedures is one Hurdle – Getting Everyone to Adhere to Them is Another

The project-control team serves the needs of the project, allowing project managers to do their job effectively and efficiently, confidently making decisions and delivering key information to owners. Decisions made by the project-control team during each phase of the project have a direct impact on schedule, budget, and performance.

The core competencies of the team should include estimating, planning, scheduling, cost control, change management, progress, and forecasting. Dodge Data & Analytics reports that cost management or cost control is the No. 1 skill set of a formal project-control team. Communication skills within the department and across the organization are crucial. If one department incurs any risk, there will be a ripple effect that then carries over to the entire project.

It is important to note that If you do not have a formal project-control apparatus within your organization, do not dismay. Many owners start by hiring one full-time person to start the project-control team. As your project volume or project complexity increases, you can specialize and grow the project-control organization by adding specialized skills at your own pace. Simply taking the steps to "own" this function and not leave it in the hands of your contractor is a best practice that puts you ahead of many other owners in the marketplace.

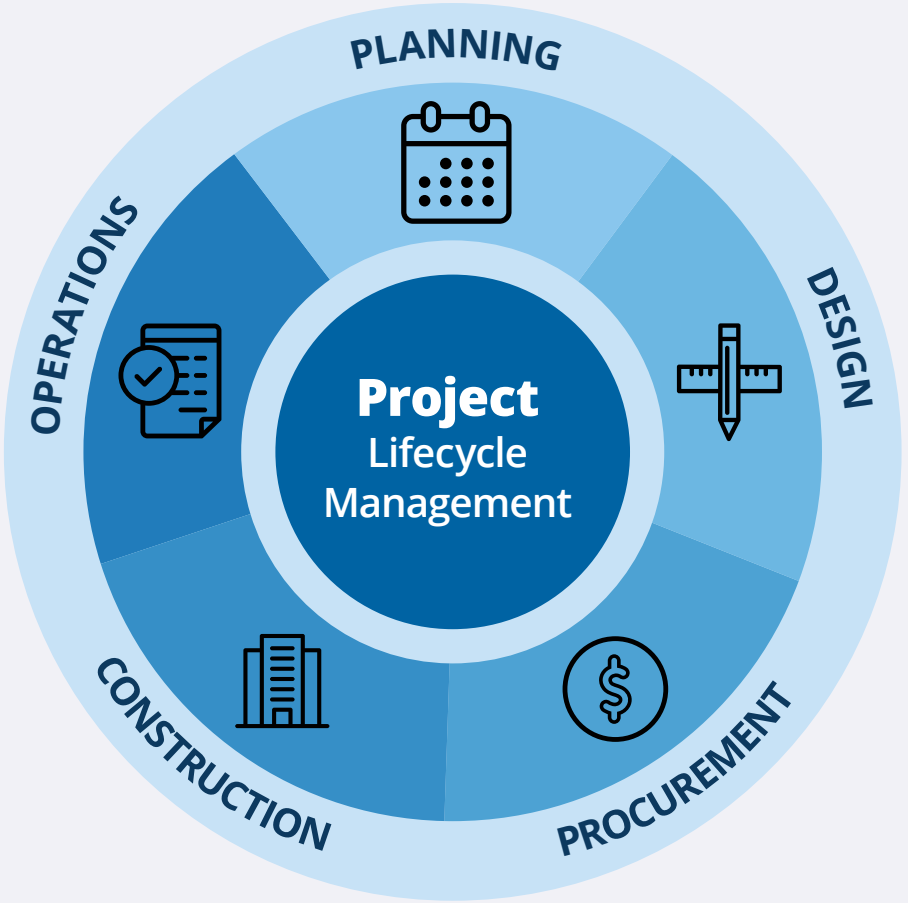
When developing a project-control team, you should consider the following:

Interpersonal Skills

- Hire an experienced project-control professional with demonstrated experience in leading process and technology roll-outs.
- The leader should have excellent leadership and soft skills, lead with authority, and have a customer-service-oriented approach.

Project-Control Skill Set

- The top priorities should be implementation of cost, budget management, and document controls. Capabilities in planning and scheduling, estimating, and risk management should be secondary, as these skills can be leveraged from contractors.
- Cost engineers, not just cost estimators, are important. Having someone on the team who is familiar with accounting systems is a must for cost estimating, job cycle, and earned-value functions, among others.
- A certified PMP whose project management experience includes 4,500 hours leading and directing projects within a 3-year period.
- Working knowledge of leading owner-centric project management information system (PMIS) software, such as e-Builder, that offers capabilities across the entire life cycle of the program:
  - Planning
  - Design
  - Procurement
  - Construction
  - Operations



03

Project-Management Information Systems (PMIS)

Improving Productivity with Technology

There are three basic technology platforms used in today's planning, design, and construction process:

1

Design platforms that include computer-aided design (CAD) and building information modeling (BIM) with clash resolution help organizations define and communicate the scope of what is to be built.

2

Project-management information systems (PMIS), which manage people, processes, costs, and communications throughout the life cycle of a capital project.

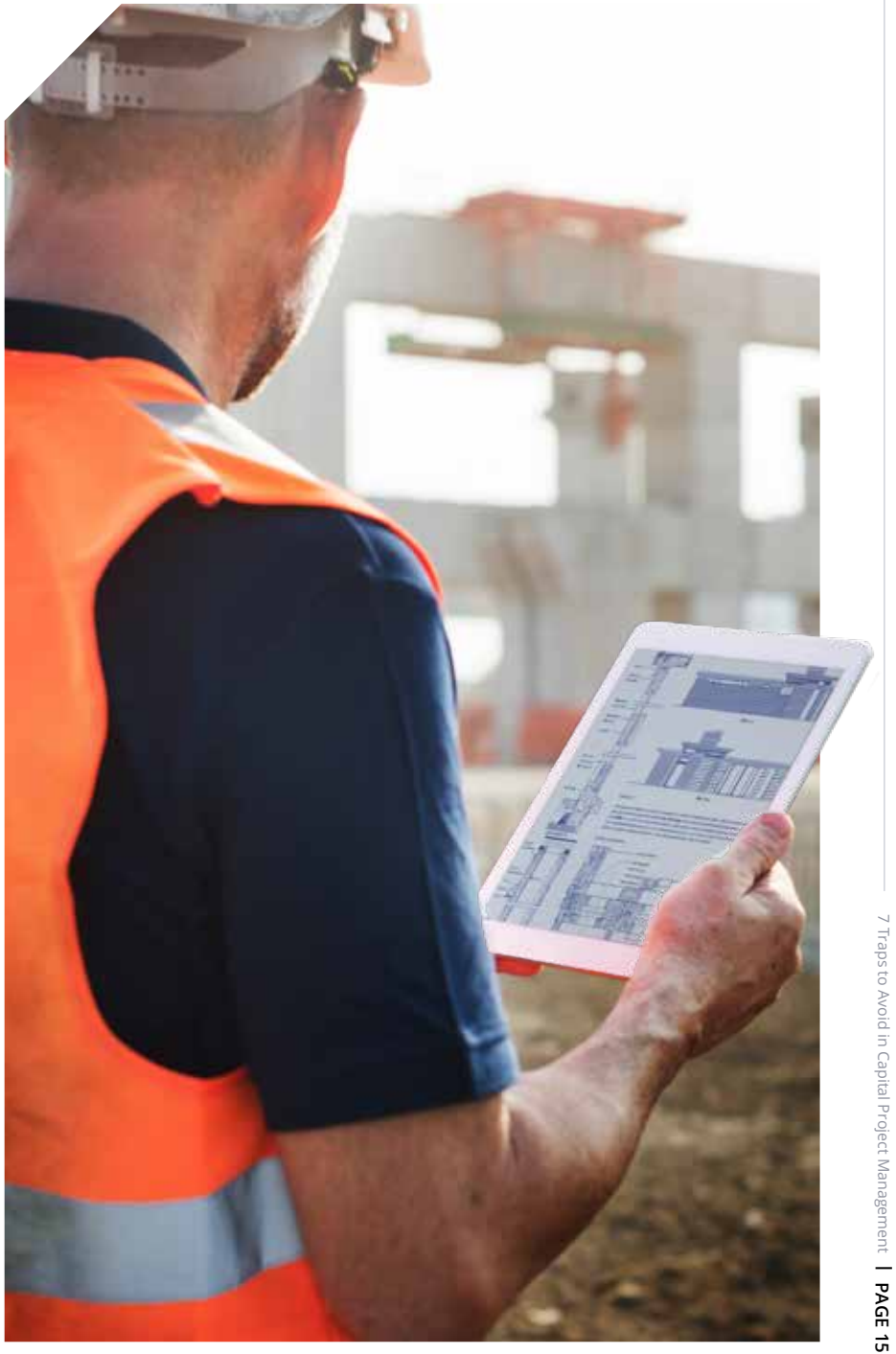
3

Facility and asset-management systems, which manage facility maintenance and operations once the project is complete.

Three decades ago, the design community embraced CAD, but it took years of development and a few courageous designers to dive in and make it work efficiently. Today, it's the industry standard. Similarly, PMIS programs like e-Builder began in the 1990s and have progressed to become trusted and valuable tools. BIM, on the other hand, is still evolving from a 3-D design-modeling and clash-resolution tool to a facilities-operations tool for managing building equipment and systems beyond construction. It holds the promise of becoming a visual interface for facilities throughout their lifespan.

Owner-Centric PMIS vs. Contractor-Centric PMIS:

Contractors use contractor-centric PMIS tools for day-to-day operations. They were great for managing subcontractors, tracking change orders, and driving profitability. You, as the owner, will find those systems to be inadequate for owner-centric management functions, such as tracking the use of funding sources; collaboration of information between consultants and contractors; tracking response times for submittals, RFIs, etc.; coordinating project-cost codes with finance (accounting) cost codes; and executive reporting of program-level information.



There is a significant difference between owner-centric project management applications and contractor-centric applications. Here is a quick run-down of the primary differences:

Owner-Centric PMIS	Contractor-Centric PMIS
Collaborative – Intended for the entire project team	**Company-specific** – Intended for the general contractor (may have "filtered portals" for the owner)
Owner and **buget-focused**	Contractor-**profit-focused**
Reduces total changes by tracking submitted change orders back to the details included by the owner's team in potential change orders and often back to RFI solutions	Substantiate change orders by tracking changes to contracts with subcontractors and suppliers
Applies across the entire project lifecycle from capital planning, design, procurement, construction, and commissioning	Applies only to construction phase (once the contract is awarded)
Program-management enabled: All about managing a portfolio of projects. Allows a single contract value to be split among multiple projects, as in the case of a master architect or engineer, designing multiple projects included in one capital program	**Project-management-enabled:** all about managing one specific project
Designed to integrate with owner enterprise applications such as accounting and finance, electronic signatures, facilities management, geographic information systems (GIS), building information management (BIM), and resource management	Designed to integrate with contractor systems such as Sage 300, QuickBooks, Dexter+Chaney, and scheduling systems

Procedures, management controls, and reporting are most effective when managed by a dedicated individual or team working in a collaborative PMIS in a dedicated "project-control center." Whether managing multiple small projects or a single large project, a project-control center with a dedicated staff has become an industry best practice.

This "center" provides valuable support to project managers and executives in organizing the flow of information, submittals, questions and answers, deliverables, invoices, and notices to and from the myriad of consultants, architects, engineers, contractors, subcontractors, authorities, and agencies involved in projects. The project-control center drives business compliance by automatically documenting and filing the information received. Just as valuable is the addition of date and time stamps when information is exchanged, transmitted, changed, responded to, or moved.

The project control center is the keeper of the owner's records of correspondence, documents, files, minutes, meetings, action lists and deliverables. The primary importance of this system is its ability to drive compliance with your business rules (not the software vendor's).

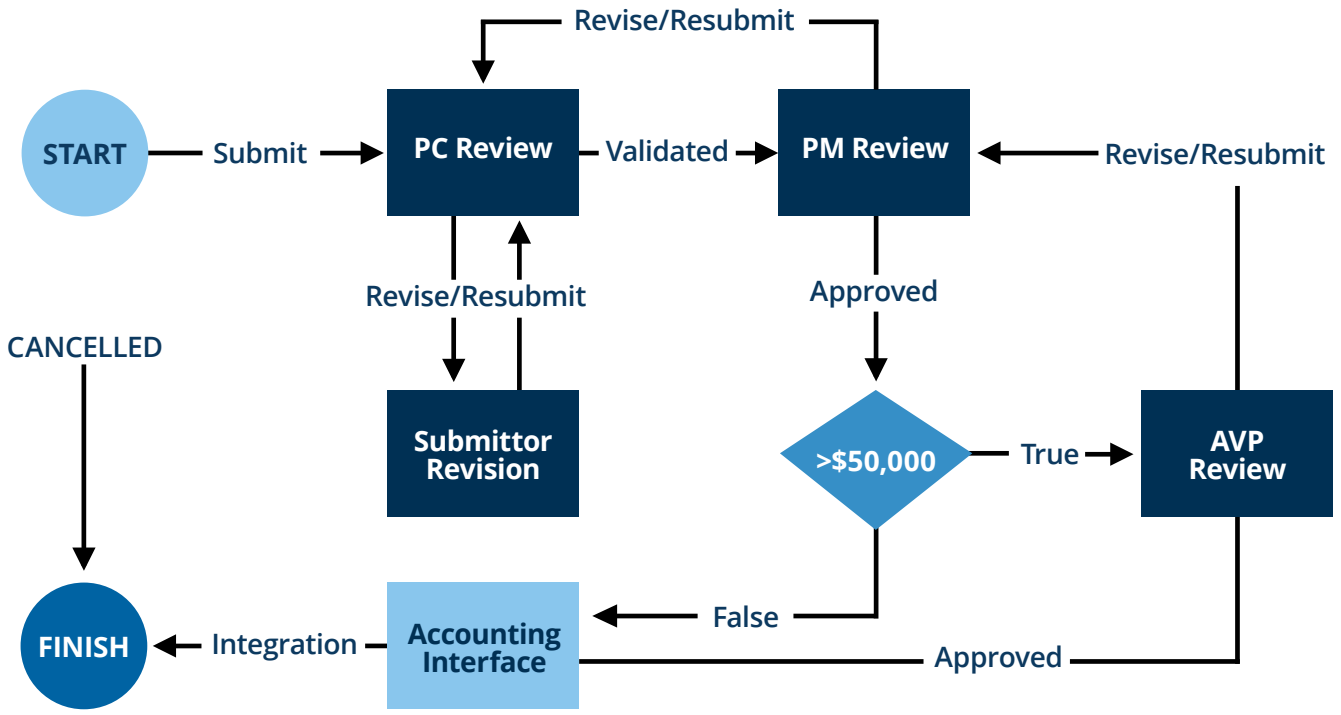
The number and background of the control center staff depends on the complexity of the project. Assigned staff should be familiar with your processes, capable of reading contract terms, and proficient in managing the tasks and deliverables required by each team member. The group should include a strong facilitator, who will be coordinating with different personalities – from contractors and suppliers to consultants and the owner's staff.

Setting up a project-control center on large, complex capital projects has become standard operating procedure on well-run projects. These typically include staff with technical and administrative backgrounds who are proficient with design and construction activities and nomenclature. They report directly to the project manager or director and manage many administrative duties, allowing managers to handle RFIs, change orders, risk strategies, and forecasts. Control centers are an efficient method of managing large and small projects.

Developing a collaborative environment between planning, design, construction, and operations teams is the most effective way to drive process compliance and manage risks. Cloud-based construction-program management software has been the gold standard for high performance project teams for more than 10 years. When PMIS applications are properly implemented, the project organization becomes very collaborative, efficient, and cost-effective. **PMIS, properly implemented, has a direct impact on failure traits 1 through 7 from Part 1.**

TIP

Organizations can create overly complicated workflows, forms, and reporting templates when trying to incorporate everyone's wish list and pet procedures. Stakeholders on your team can demand to be included in approval loops, even when other, more-capable staff have the actual responsibility. Incorporating unnecessary procedures or people, bogs down the day-to-day process and discourages adoption and full use of a PMIS. A properly implemented system includes streamlined workflows with a reasonable amount of checks and balances. Great organizations use cycle-time performance data to go back and streamline their workflow processes to achieve breakthrough results that exceed 10% productivity gains.



04

Return on Investment

Measuring Success and Capturing Return on Investment

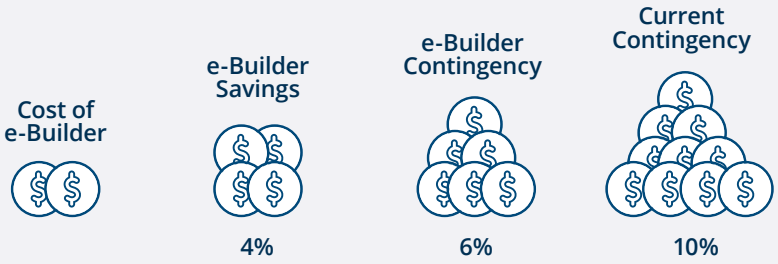
When deciding whether to invest in a project-control function and ownercentric PMIS, the most frequently asked questions are "How much does it cost?" and "Is the cost really worth it?" The cost and return on investment (ROI) are scalable and often commensurate with the size and complexity of the program. Below are some major areas in which ROI can be assessed and measured.

1 Productivity Improvement

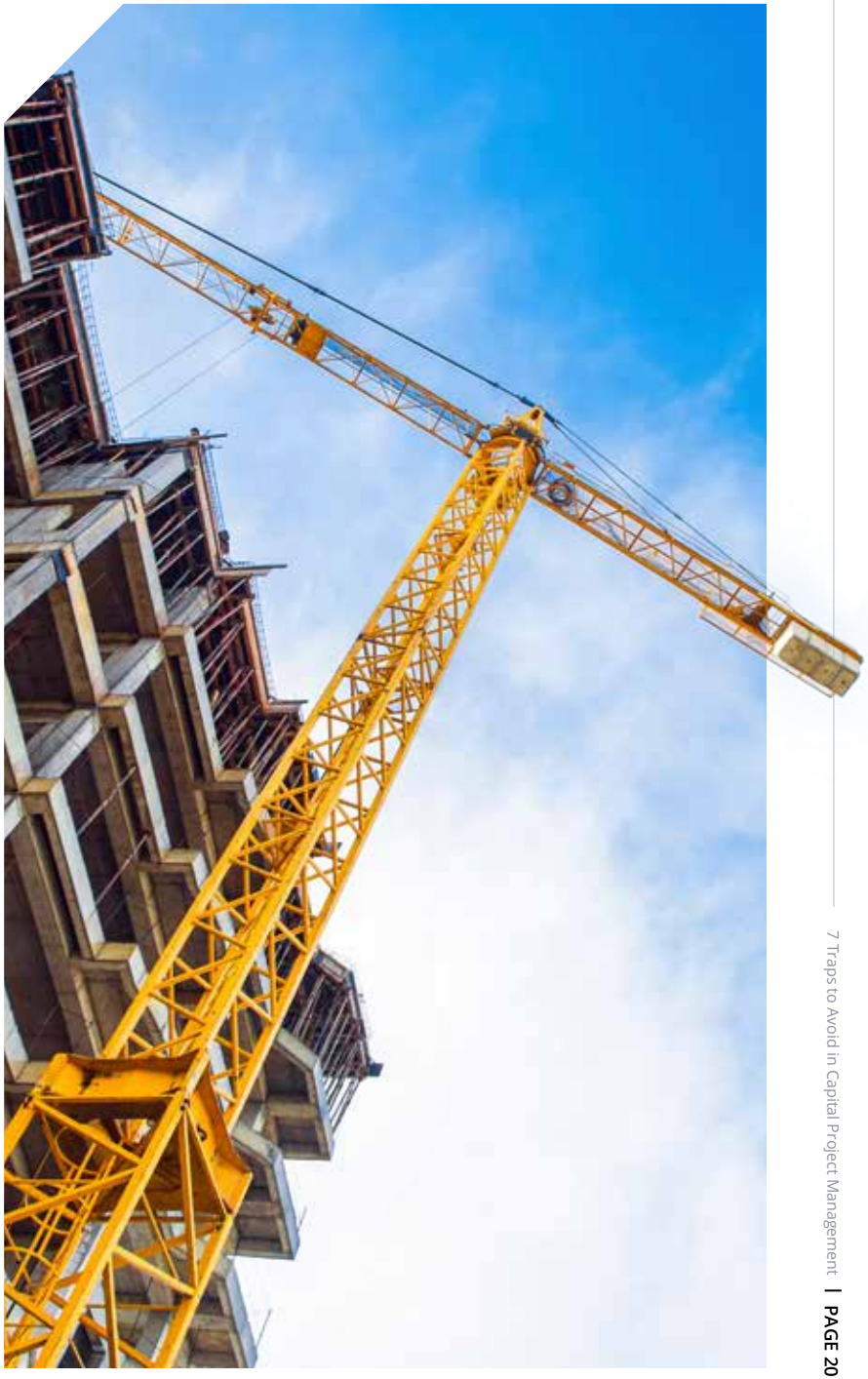
Your organization will have the ability to efficiently take on additional projects with existing staff. PMIS, with the support of the Project Control Center (PCC), improves productivity by reducing mundane data re-input, digitally capturing and exchanging data vs. paper-based workflows, and quickly storing and retrieving the latest project information from one central location. With project information being consistently and electronically entered into a central PMIS, hours and days are also saved on consolidating information for project status and cash-flow reports. These improvements can be measured by automatically tracking individual task times and the overall duration of key processes – such as payments, approvals, and change orders –through your PMIS. Ultimately, you will see an increase in the quantity of projects and construction dollars managed per staff member.

PROGRAM BUDGET

"Doing nothing will cost you more than doing something."



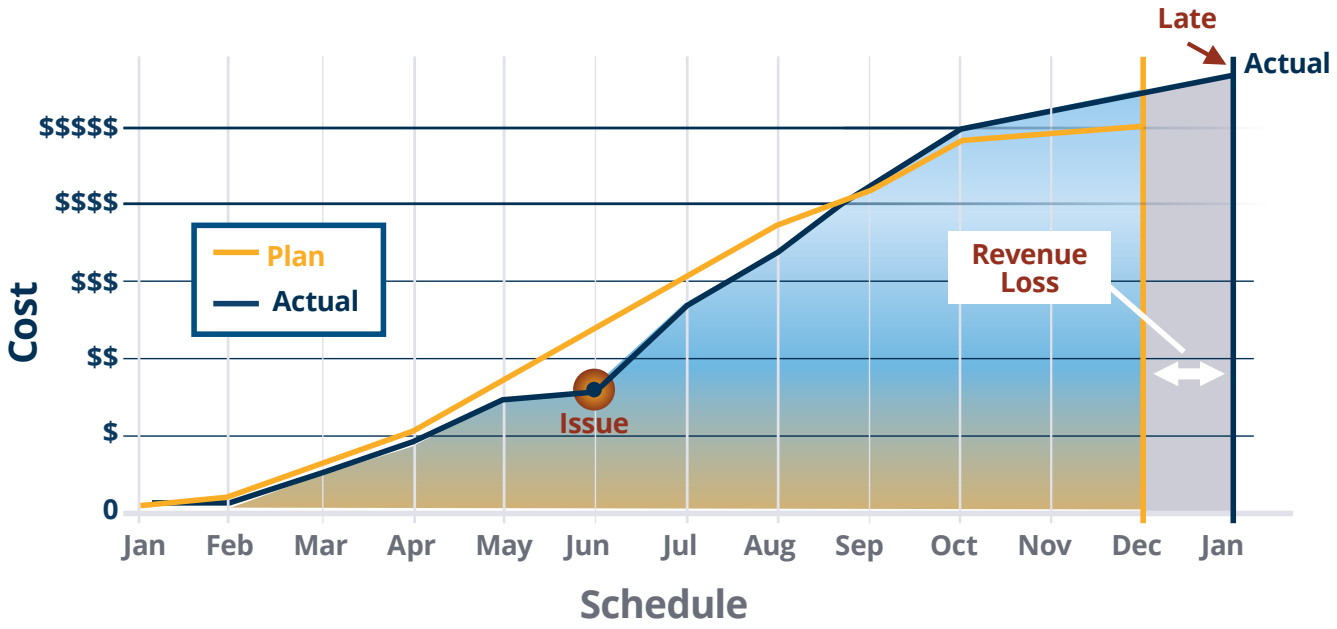
+4% – $Millions SAVED



2 Process Cycle Time Reduction

There are significant cost benefits to speeding up reviews, approvals, information transmittals, payments, etc. When information flows more quickly, it reduces the "ripple effect" of negative impacts down the line in a project. For example, when a request for information (RFI) goes unanswered for too long, a contractor may miss the deadline to procure materials that are needed to proceed with work on schedule. If the contractor misses that deadline, it is going to propose a change-order request to get additional money to cover acceleration costs to stay on the original schedule. Those acceleration costs are expressed in paying overtime to staff and a premium on last-minute procurement of materials after the RFI is finally answered. When construction tasks or procurement gets too compressed, the chances for errors and quality deficiencies begin to increase. The risk and magnitude of negative cost and schedule impact on a project drastically go up when information and key processes take too long. When using a PMIS, processes are consistently being executed across all projects, and process durations and iterations are automatically captured. Through historical data automatically reported from the PMIS, you can identify trends on why some projects or staff are performing better than others. Process-cycle time and the number of iterations can be correlated with quantitative data, such as the number of change orders, late payments, disputes, claims, cost overruns, schedule delays, or quality deficiencies reported on certain projects.

Unidentified Issues Derail the Project



3 Project Cost Savings

By improving staff productivity, accelerating the flow of information, and reducing the number of iterations on key processes, owners can capture material cost savings of 4% or greater in their construction programs. For example, when payments to contractors are expedited, not only are late-payment penalties avoided, but contractors also are incentivized to work for you and offer more competitive bids. Contractor carrying costs often attributed to long payment cycle times are reduced. Change-order pricing is generally more fair, and it takes less time to discuss or negotiate the final cost.

Staying on schedule and opening the doors to your facility on time can make a huge impact on revenue generation, as well as reduce financing costs. PMIS, BIM, and firm stakeholder design review processes early in a project's life cycle greatly reduce the chances for operational disruption and rework costs. For example, health care facilities have some of the most complex and costly MEP (mechanical, electrical, and plumbing) requirements. If equipment vendors and end stakeholders aren't actively involved in verifying that designs meet their requirements, costly demolition and rework might be required post-construction, which disrupts operations of your facility. Many owners have reported spending hundreds of thousands of dollars in post-construction rework scenarios in which the completed facility didn't match the equipment requirements. When a facility is closed, it isn't generating revenue and strains other facility resources.

4 Program Transparency

In public-sector construction projects, there are often audit or reporting requirements to reflect how funding was allocated, or special procedures for processing changes to projects. PMIS allows government agencies to automatically track and put controls in place so that the project remains in compliance with codes. In addition to this, when public-sector construction programs can provide quantitative data indicating that projects are on time, on budget, and within scope, it makes it easier to raise federal, state, and local funds through bonds and other financial sources.

5 Real-Time Visibility and Accurate Forecasting

During the program-planning process, initial project budgets and requirements are put together. Owners may pad preliminary project budgets for unforeseen conditions or based on early scope information. As projects move from planning to construction, project budgets and cost commitments become more refined. By utilizing an owner-centric PMIS, project and program managers obtain accurate cost-forecasting visibility for the duration of their projects. Accurate early forecasting can uncover unused funds that can be reallocated back into the program budget early, allocated to other projects that are at risk for cost overruns, or used to execute additional projects to meet strategic goals. PMIS systems also hold a wealth of historical project data that can be used to accurately plan project budgets in the future.

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6 Refuting Claims and Disputes

Disputes and claims still will come up on projects. The key is how prepared will you be to refute and minimize their impact by having an accurate audit trail of documentation, activities, and players involved? With a PMIS, all this information is consistently captured by an owner in one central location and can be quickly and easily retrieved. Hundreds of thousands to millions of dollars in claims can often be avoided by being prepared beforehand. No owner wants to incur long, drawn-out claims negotiations, pay significant legal and discovery fees, or attract negative press to their organization.

Additional Project Examples

Health Care Project: Recently, a major health system thought it was in good shape at the start of construction on a $350 million project, but wanted confirmation. After an extensive project audit, risk assessment, and cost-forecast analysis, it was determined they were $19 million over budget based on decisions they had made. The program manager had never analyzed the risks inherent in a complicated $350 million project, nor did he evaluate the probability or severity of those risks, or forecast the anticipated "end" cost of the project. The project manager was struggling to manage the amount of data and decisions coming at him from the large national design and construction firms involved, so typical risks were not accounted for in his budget. He mistakenly led stakeholders in the organization to believe they had funds available to add scope when they did not. They had deviated from their own strategic plan and were spending on items with little or no return on investment. It was painful to rewind the project, but by setting up proper controls and a formal cost-recovery plan, the project was ultimately brought back into budget. If the problem had continued unnoticed without proper controls in place for an additional three months, the project would have been too far down the road to pull back.

Public-Sector Project: A public authority was known for hiring inexperienced staff and providing slow response times and late payments. It had few bidders (always the same firms) for projects, and over the years, contractors took advantage of the situation. Contractors were known to underbid the actual cost to keep out competition, then later load the project with change orders to make up their financial position.

The authority recently began a major capital-improvement program that called for tripling its annual construction effort, so it wisely hired outside firms to assist in implementing better procedures and leveraging a PMIS system. RFIs, change orders, submittals, and invoices are moving through the system much faster, and new firms are taking notice. Without this change, they would never have been able to implement the number of projects it will take to carry out the entire capitalimprovement program. Schedule and project costs would not be well-controlled.

05

Summary

The results from strategic and financial initiatives are very positive when projects are well-planned and executed. Identifying top risks and challenges, setting up program-management controls, and implementing PMIS will elicit the following outcomes:

1. Capital investments are aligned to your business strategies.
2. You have stronger control over where capital funds are allocated.
3. Proper use of experienced staff, procedures, and project controls will cost less in the long run.
4. Scope creep and re-design will be held to a minimum.
5. Fewer claims.
6. Staff, consultants, designers, and contractors will perform at a higher level.
7. Date and time-stamped data provide the ability to drill down into the details of who's staying on top of their work and who isn't. Those who aren't can be encouraged or trained to elevate their level of effort.
8. You own the information and data generated by all team members, so keep your organization in front of the project and better prepared for change-order negotiations and/or to defend against claims.

About the Survival Guide

Trimble, teamed up with Berkeley Research Group to unpack the common challenges facing owners of capital projects and deliver a practical survival guide that any top leader of capital projects can implement to make gamechanging improvements to their project performance.

Berkeley Research Group (BRG) – by providing "capital-project development," "claims-litigation support," "performance improvement," and "corporate restructuring" services – is in a great position to gather and evaluate data from successes and recurring failures on capital projects to determine the root causes of those failures and their impact on operations. BRG Advisory Services provides clients with specific measures they can take to mitigate the causes of typical failures.

About Trimble

Trimble is developing technology, software and services that drive the digital transformation of construction with solutions that span the entire architecture, engineering and construction (AEC) industry. Empowering teams across the construction lifecycle, Trimble's innovative approach improves coordination and collaboration between stakeholders, teams, phases and processes. Trimble's Connected Construction strategy gives users control of their operations with best-in-class solutions and a common data environment. By automating work and transforming workflows, Trimble is enabling construction professionals to improve productivity, quality, transparency, safety, sustainability and deliver each project with confidence.

For more information, visit: construction.trimble.com