Project Management Information Systems

Charles Thomsen FAIA FCMAA

charlesthomsen@charlesthomsen.com

Table of Contents

PROJECT MANAGEMENT
INFORMATION SYSTEMS

Like BIM, a PMIS is a web-based, centralized database created and used by the project team. A PMIS is to the process what BIM is to the product. Both are collaboration software: centralized stores of integrated information with rules for access that serve the project team. Both are important tools for collaboration.

BIM is sexy. The PMIS is a neglected wallflower. BIM represents the physical building: the goal, a lighted 3D image on a monitor that is the rewarding culmination of everyone's creative effort. The words, numbers and diagrams in a PMIS don't excite design-oriented AEs or fabrication-oriented builders. Nor are they a high priority for the action-oriented managers of design and construction.

These personalities like the interaction of teams, the intellectual exchange among smart people, the challenge of design and the satisfaction of seeing buildings emerge—on a screen and in the field. They're not thrilled by the chores of methodical documentation. And while people can see their own contribution to a 3D electronic model, it's hard to get job satisfaction out of input into an impersonal alphanumeric database. So it's difficult to whip up support and convince a team that a PMIS will improve projects.

Overview

This discussion has three sections to describe a PMIS system. It explains its components, reviews its value and discusses some of the challenges of implementation.

Components of a PMIS

The PMIS defines the program and the projects: cost, time, scope and quality. It defines the team: people, organizations and their roles. It helps manage agreements: contracts, permits, approvals and commitments. It manages documents. It produces standard and custom reports. It presents vital signs on dashboards. It guides collaboration and communicates best practices with policies, workflow diagrams and document management.

Values of a PMIS

A PMIS provides information so the team has a common understanding of the facts: a prerequisite for collaboration. It's the cheapest way to gather information because it's only done once. And it's the most reliable way to host information because many eyes scrutinize centralized data and and mistakes are more likely to be found and corrected. It's the first line of defense against political or legal attack. It's a clear window into the project that leaders can use instead of relying on delayed or biased reports filtered through layers of management. It improves performance because it measures it; it's a report card for both team members and management. And most important, it educates the team and makes better managers because it tells true stories.

Information is the input and the output of managers who gather, validate, integrate, record, add experience, make judgments and then give directions.

Challenges of implementation

The voice of authority from a committed owner is essential to a successful PMIS. There's always a bumpy startup while the team adjusts to the routine discipline of entering and sharing information. Some team members will have a hard time accepting change and will neglect the responsibility to provide input. Initially, there will be glitches in the data that provide targets for criticism. Engineering the human system to maintain timely and reliable information flow is the hardest part. Success requires support from the top brass.

The startup is bumpy.

Interoperability has been a problem but there is progress. PMIS systems can be interfaced with different software used by other organizations to minimize the chores of data entry.

Components of a PMIS

Defining the projects and the team: people, organizations and their roles

A PMIS is built around documentation and communication of project-specific information so most of the engine is devoted to that purpose. Basic project information includes the project location, a current calendar and the project goals.

There may be web cameras that record on-site activities for public relations or for evidence in case of conflict. There may be general public relations web pages with access for the community, users or other stakeholders.

The PMIS maintains project status from the initial idea for a new facility to it's completion. Such project data may be rolled up for portfolio management and for planning future projects.

As the PMIS develops it will accumulate detailed project information on:

Cost

Each contract and each project will have the budget, estimates, contract amounts, changes orders, contingencies and forecasts of completion cost. There may be a capital plan with projects scheduled over future years. It may include funding sources.

Schedule

There will be a master schedule, design schedules, procurement schedules, global "push" construction schedules, short interval "pull" schedules, closeout schedules, occupancy schedules and commissioning schedules.

Or there may be a project-specific calendar so the extended project team can coordinate their work. It may display meetings that the user must attend, show deadlines for the user's work products and send automatic reminders. There may be a user-customized calendar for specific responsibilities.

Quality

Given that most owners choose to define quality as "conformance to requirements," the PMIS may include space programs and other requirements. The PMIS may include procedures for quality control or quality assurance programs, post evaluation data and include checklists to meet regulatory requirements.

Projects:
    People, organizations, roles, etc.

Cost
    Budgets, estimates, VE, payments, etc.

Schedule
    Master, push, pull, design, construction, occupancy, etc.

Quality
    Scope, requirements, compliance, etc.

The team: people, organizations and their roles

Within the PMIS database there is a simple list of the projects with contact information for each company, its key people and their project role. Since so many people deliver a project it makes sense to have a resource where everyone can find everyone else. And it sure helps to know how they fit into the project. A web-accessible database with that information improves communication. That speeds the project.

It also adds to the quality of the work. When starting a new project, it helps to know what companies have done similar work and how they performed.

Managing agreements and documents

Nothing happens until there are agreements with someone to do work. Because organizations must work together, interlacing and tracking agreements is a management challenge. Managers must plan who is going to do what, communicate those tasks, make sure there is clear agreement and then track the execution.

Agreements

The PMIS records agreements. In general, agreements can be categorized in four major groups.

- Contracts: The PMIS will include a database of the contracts for reference. It will also summarize the scope of work, the financial aspects of the contract and the general terms and conditions. Often problems arise because contracts are negotiated between executives and not explained to execution teams. There are mistakes because people just don't understand their job. If the scope of work is accessible online it makes it easer for leaders to monitor progress and ensure compliance.

- Owner approvals: The owner's organization must be managed as well as the design and construction groups. The owner will have policies that govern approvals. They will want to approve designs, change orders, color samples and so on. Some approvals will be contractually required; others will be less formal but important to manage. Accounting must know to schedule cash flow; the legal department must know when to prepare contracts.

- Agency permissions and permits: The project will be constrained by permitting, entitlement and other regulatory agencies. It will help the project team members to have requirements for these permissions online. Many permits have time-based requirements that need a reminder that is triggered by other events or tasks.

The work on a project is created with agreements. In general, there are

- Contracts
- Owner approvals
- Agency permissions and permits
- Routine commitments

For example, a building permit for foundations may not cover the structural frame. If the permit department require 30 days to review the structural design for approval, the system reminds everyone early enough to ensure the design is done on time.

- Routine commitments: Many enlightened managers argue that a project should be viewed as a network of commitments—often verbal and often made in routine coordination meetings. A project culture that places high priority on honoring these routine commitments produces better projects. Recording them in a PMIS adds clarity and importance to the commitment and managers can see that they aren't neglected.

Document management

The PMIS will have a file structure that is the complete project central filing system. It will provide storage, retrieval and distribution of project documentation: written documents and drawings. It will be defined centrally. Folders can be added as projects progress. The system will time-stamp and track document activity. There will be tools to mark up or comment on drawings.[1]

A PMIS filing system is more than a "shared drive" or an FTP site. The team can access and view files without the native software (for instance, an administrator can view a CAD drawing without the CAD software). Like an FTP site, authorized members of the extended project team can access the filing cabinet,[2] but sophisticated multi-level permissions are built into the PMIS. There can be links between documents and other "objects" in the system like cost data or RFI forms.

Standard and custom reports

A report can be a standard "push" report, a custom "pull" report or a summary "dashboard." They may be on a computer screen, emailed or printed.

---

[1] Integration of PMIS with BIM systems is a task that requires serious head scratching. As BIM systems receive input from various parties, their contributions need to be logged in. As various parties review drawings their comments must be recorded. Are these tasks part of the BIM system or part of the PMIS? Or will the systems grow together?

[2] As we progress to paperless electronic records, the team must understand that document management includes electronic as well as paper documents.

Standard "push" reports

Managers must determine who should know what: how to inform and educate the project team and their bosses. They support that responsibility with reports that are "pushed" to the recipients.

Push reports may be routine status information or notifications when action is required. They filter data according to the requirements of the recipient. The objective is to send the right information—no more no less. Sending everything to everybody is nearly as bad as sending nothing to no one. Too much information obfuscates vital signs.

Custom "pull" reports

There's always a new question. A board member may want to know how many companies working on the project are local, a construction superintendent may want to know the number of people on site on a given day or a project manager may want a list of events that reduced a project contingency.

So a PMIS needs a simple tool that allows a non-technical user (with the proper credentials) to "pull" information from the database, arrange it for analysis or import it into spreadsheet, presentation or word processing software. Pull reports may be ad hoc or routine.

Dashboards

Too often, the big picture is buried under layers of minutia. To avoid that, the system must present an easy-to-grasp, conceptual view of the program with graphs, diagrams and alphanumeric summaries of vital signs. But if a user is interested, he or she should be able to drill down into the details.

Summary roll-up reports

The PMIS should roll up and summarize both contract and project information into a presentation of information for the entire program. At the program level, a user should be able to view cost, schedule and quality summaries along with the program contingency, cash flow, and other summaries of project information.

In the context of the total program, the PMIS should provide a "Project View" or a "Contract View." Projects are done with multiple contracts, but many contracts are for multiple projects. For instance, "horizontal" procurement of goods and services is common in building programs (e.g., an owner may buy carpet for several projects). So the program needs to provide information "vertically"

There are a variety of reports including:

- Push reports
- Pull reports
- Dashboards
- Summary Roll-up reports
- Performance metrics

Push reports are automatic. Managers don't have to stop to waste time creating them. And because they filter data for the recipient, they communicate more efficiently. Pull reports are custom designed by the user—almost at will.

(for projects) or "horizontally" (the same cost and schedule information for companies working on multiple projects).[3]

Performance metrics

These little indicators of current project health typically include statements of cost and schedule growth, items such as RFI aging, status of approvals, change order resolution and other project-level detail. Many users like to use green, yellow and red "traffic light" signals to color-code these indicators. Then these project results can be filed in historical databases to provide guidelines for planning future projects.

Guiding collaboration with policies and workflow diagrams

A PMIS is a control tool. Owners can prime the PMIS with policy or regulatory requirements that govern the workflow and institutionalize best practices that are specially designed for their organization.

Policies

If team members are to collaborate, they need to know the rules of engagement: how to work together. They must understand the policies that govern interaction, workflow and decision-making—how and when information is passed person-to-person and organization-to-organization. Properly honed, clearly documented but flexible procedures improve the efficiency of the team. People are far more productive when they have a clear idea of what to do.

When these policy and procedures manuals are electronic they can use all the tools of electronic communication like mouse-over pop-up boxes, hyperlinks and animation. They are also easy to access and update because they reside in only one place. And anyone with web access can get to them.

Smart folders and electronic forms

The program manager can set up a PMIS with folders that are programmed to notify specified people when a document is filed. Or electronic forms may be programmed to do the same. That allows managers to design decision-making and control.

For instance, an RFI placed in the PMIS may be routed to the architect and the project manager. The folder can also have a "side car" blog site for discussion contents.[4]

Policy manuals should be part of a PMIS. After the initial installation of a PMIS, the team can experiment with smart folders, electronic forms and defined procedures. Its harder to do that it first appears.

---

[3] As in all database programs, there will be infinite ways to slice and dice the information but normally it will be done within the context of projects or contracts.

Standards

As owners execute a program, they develop standards to form baselines for continuous improvement. The standards may be for process (contracts, approval requirements etc.) or for product (design guidelines. preferred building systems etc.) They are stored in the PMIS along with links to the requirements of entitlement and permitting agencies.

Values of a PMIS

The owner pays for the PMIS—and of course, the reason is to improve the building program and ultimately their mission; to achieve higher quality, faster project delivery and lower cost—self-evident values in the quest to improve a competitive position, obtain more facilities with available dollars or operate more efficiently

The purpose of a PMIS is to help an owner achieve its mission. That purpose can be lost in detail.

To be precisely accurate the PMIS does none of these things. What is does do is to inform people so they can make decisions to accomplish those goals more effectively. But sometimes it takes a leap of faith to see the connection between implementing a PMIS and those noble objectives. Sometimes it is lost in detail and procedure.

Here's an explanation of some of those connections.

Information for common understanding: a prerequisite for collaboration

Collaboration requires a common understanding of purpose and the relevant facts. A PMIS will never replace face-to-face meetings, but there's too much information on even the smallest project to hold in our brains. So we need a rigorous, disciplined system. Although people always have some self-interest coloring their attitudes, conflicts subside with shared information. Providing the same information to everyone brings cohesion to the team. There are daily, small decisions that inform the project team about the proportionate values the leaders place on cost, schedule and scope. If the team understands those decisions they better understand how to make decisions about their own work.

Here's an astonishing reality. If there is no disciplined PMIS, there will be confusion about the fundamentals: budget, schedule and scope. Each will be represented with different definitions and

---

[4] This task is harder to do than it might first appear and should not be part of the initial start-up program. See comments under Electronic forms and smart folders, page 18.

conflicting data in multiple, unrelated documents in different filing cabinets.

The Holy Grail of a PMIS is to replace these different filing cabinets and tons of paper with a centralized, comprehensive, near real-time, web-accessible database of electronic project information, available 24/7. Like BIM, it's a resource for the team, created by the team. The chore of data collection is endured only once and the pleasure of getting accurate needed information is enjoyed often.

The cheapest and most reliable way to document and communicate information

At first glance, one might look at an extensive PMIS and ask, *"Who collects all that data? What a chore! Isn't it costly?"*

The reverse is true. A PMIS reduces the cost of data collection. First, it's data that's always collected—usually repeated by several organizations. Second, with a PMIS the collection job is shared: the PM, the CM, the AE, etc., and then shared by all.

A PMIS saves money because the project documentation process is clearly defined and there is less duplication of effort in implementation.

Without a standardized PMIS, the same data will be recorded multiple times by multiple people in multiple filing cabinets and computers. Collection is inefficient and costly, and the data is inconsistent and unreliable.

With a PMIS, there is only one on-line filing cabinet. Responsibility for data entry is assigned to the appropriate people and those who need and use that information may access it, review it or download it—a far more efficient approach.

Armor for defense against political or legal attack

Projects experience conflict. It may be a lawyer searching for evidence to support a claim, a user who is mad at the director of facilities or a reporter looking for a tabloid story. An abundance of uncontrolled and conflicting documentation provides a target-rich environment for those searching for evidence to support a biased point of view.

Hard project facts are the arsenal of defense. If there are defined project goals and if they are consistently maintained with current data, the owner and the facilities team will have plenty of ammunition for support. If there is a legal challenge, a PMIS will help the owner find facts for support. Typically, paper document storage warehouses have poor search capabilities. A PMIS with centralized electronic documents will lower discovery costs and reduce the time required of

There is always conflict with big projects. Facts are ammunition.

executives to assemble exhibits. When there is a dispute, the team with the facts is the odds-on favorite to win.

A window into the project

Any executive who has had the responsibility for a complicated process, implemented by layers of organization, executed by multiple companies, understands how hard it is to know what's going on, what's happened and what's the likely outcome of the current state of affairs. It is difficult to understand progress toward a goal, to know what caused problems and what contributed to success. A PMIS informs leaders about current progress so they can operate the levers of control.

It is hard for leaders to know what is going on with a project.

A PMIS is a management tool for control and collaboration. Control systems require feedback to measure progress so adjustments can be made to stay on track. With all the computers at NASA and all the fixed laws of the physical universe, NASA must still make on-course adjustments to hit the moon. Managing capital building programs is harder because the target may change and we don't have the laws of physics to control the behavior of people and organizations. Leaders must stay in control—not only to stay on course as unpredictable events unfold but also to change course when the destination changes. That means that they must know what's going on.

Before we had computers, managers had to live with human layers of reporting. Top managers dealt with concepts and left the details of execution to the project managers and field engineers. Field engineers periodically passed information to project managers who passed it to middle managers who repackaged it for top management.

A layered reporting structure has common flaws: reports may be slow, idiosyncratic, filtered, inconsistent or biased. When a program-wide roll-up report is needed, the data needs to be reviewed for consistency at each layer and then consolidated. It's costly: everyone spends time gathering, packaging and reporting—sometimes inventing perplexing formats for each new report.

Centralized, web-accessible management information

Twenty-first century management technology makes these layers of management more transparent. Managers can open their laptop and view the report they want. That's not simply a boon for the top managers, it saves intervening layers of management from non-productive chores.

The technology increases the velocity of information flow. With human layers, the time a piece of paper makes the rounds (and waits

for someone who is on vacation or ill) it's usually stale. Putting it on-line in one place for everyone to see provides near real-time response.

As information passes through layers in the organization, it gets distorted. The one-step process of storing information in a central database reduces the chance for it to be corrupted.

Standard formats and definitions

British investors in the 19th century needed to understand the status of their investments in the new world. They developed standard accounting formats for balance sheets and income statements. Today, the Generally Accepted Accounting Principles (GAAP) establish the rules of measurement. Anyone with a basic understanding of accounting can pick up one of these standard financial reports and understand it.

The construction industry does not have these standards. If the author invents report formats, they must be explained. Terms will mean different things to different people. Basic words like "budget" or "completion" or "program requirements" or "estimate" will include different components. Documents that contain crucial information will be changed and updated in some locations, not in others. Ad hoc reports presented in author-invented formats will be hard to understand. A spreadsheet will have cryptic column headings understood only be the originator.

So a good manager standardizes formats and definitions that everyone learns to understand at a glance. That increases understanding and saves time.

Security levels

Of course, the window needs shutters. The team members have security levels with defined levels of password protection that control permissions to access, input or change information. Some people will have access to information on their project only, others will have input and read-only privileges, others may modify documents, etc.

Improving performance with report cards

Anyone who has been associated with education understands that measuring performance with report cards motivates students. And it provides clues to parents, teachers and administrators about their effectiveness.

The same applies to project teams. What is measured is what improves. For instance, a project may be viewed as a network of commitments to deliver work products that meet given requirements

If the IRS let taxpayers invent their own forms to show how they calculated their taxes they would have to increase their audit staff by at least a factor of 10 to understand and decode the tax filings. Ad hoc, individually designed reports on design and construction projects can also create inefficiency and misunderstanding.

Measuring performance improves performance

at a given time for a given cost. These commitments may be recorded in the PMIS and displayed in a periodic status report. That will reveal how people meet their commitments and informs project leaders. Knowing that, the firms work to improve their own performance and the leaders know whom to hire for the next project.

A PMIS will be replete with metrics that report progress against the objectives. Hundreds of little scorecards reveal the relationship between the current working estimate and the budget, the aging of RFIs, the status of submittal approvals—and on and on.

Educating management

A PMIS makes better projects. It also makes better managers because it furnishes comprehensive facts about project history. That will educate the project leadership with comprehensive understanding instead of half-truths supported by biased selections of information. Without systematic presentation, people may act (or fail to act) on the wrong information or learn the wrong lessons.

Owners want experienced managers (either in-house or outsourced) to represent their interests. They want people who understand the industry, understand how to assemble and manage the parts of a design and construction project and can cause the right action.

Valuable experience comes from learning from previous projects and anticipating that similar events might occur. To learn these lessons, leaders must have accurate reports—true stories—about what has happened. So a crucial PMIS function is to enhance judgment by a clear presentation of project activity: the cause and effect of project results.

However, there is some danger in history. It seems that every project presents an unplanned, unpredictable and unique event that requires a non-traditional approach. Again—good data from multiple projects helps reveal the outliers for special attention.

A project involves so many people, is so complex and has so many events that selective information can support different points of view and produce false conclusions. Whether a project is public, institutional or corporate, there will be many voices. There will be users, administrators, lawyers, permitting agencies, the public and perhaps investigative reporters. There will be architects, engineers, consultants, contractors, subcontractors and manufacturers. It's human nature to search for information that supports one's bias. People will filter subsets of facts based on their self-interest— whether it is high-minded professional motivation, serving a personal

It is natural for us to concoct explanations of outcomes after the fact so we may learn from our experience. However, personal bias and selective memory may lead to a misleading collection of anecdotes. Good records and hard facts help us build true stories.

agenda or controlling a company risk. Consequently, there are frequent incorrect constructions from biased selections of facts. Then someone learns the wrong lesson.

The PMIS will transfer some of the knowledge and experience from the brains of the project teams into a database. As people inevitably leave, get promoted, transfer to another department or go on vacation, they leave knowledge in the database for the benefit of the people who remain.

A PMIS won't eliminate biased viewpoints and self-interest, but it will help. It will define the goals, measure progress, document events and present the final result with standard, objective facts. Routine reports will present honest truth—not apocryphal, selected, self-serving or political stories, but honest, balanced insight into the project realities.

Challenges to implementation

An owner often hosts the PMIS, but if a program manager is the host, the owner must still commit resources and obtain agreement and engage other parts of the owner's organization (typically accounting and legal) to implement the system successfully. And, in most cases, the owner must plan to own and manage the information in the system.

Implementation groups and incremental startup

Think about having inclusive project information at your fingertips: contact information for the players, cost and schedule data for the projects, and workflow for the procedures. You can access up-to-date agreements and monitor their execution.

The categories of information in a PMIS are points on a continuum of managing construction risk, stitched together by software to present the most complete picture to the right people. That's an agreeable state of affairs.

It's easy to get enthusiastic. Ironically, enthusiasm can cause problems; while some people push back against change, others pull too hard. They think of all the lovely things that could be done (many of which we've discussed above) and set out to start, out of the box, with a system so big that they can't get it going. It staggers under the weight of bells and whistles.

The classic mistake is to organize a study group to decide on the total functionality of the PMIS. Each member of the group thinks of a valuable function to include. Each new idea makes the system bigger, the training harder, the politics more difficult and startup thornier. The system fails under the weight of its own ambition.

The reciprocal mistake is *not* to involve people in the process. Without buy-in, resistance increases. But it's better to charge them

with developing an incremental approach rather than to design the ultimate system. Some organizations tend to embrace change more easily than others, so the speed of change can be matched to the ability to absorb new processes.

The leaders should provide a long-range vision but conceive short-term milestones. Then people can participate by designing defined parts of the system: startup modules that will provide value to everyone, be easy to do, get everybody in the habit of maintaining online data and give the team a quick win.

The idea is to view the process as a journey, not a destination. There is no ultimate system. Enhancement will be continuous and forever.

A sense of higher purpose

The people who enter the data are not always the people who benefit from it so they may have a hard time understanding its value. They may view the system as management reporting. The vision of an informed, collaborative team may not be clear at first. Somehow, the leader must communicate the important role everyone plays in making it all work—how individual contributions are necessary for success.

There is a relevant quote from Antoine de Saint-Exupery.[5]

> *"To be a man is to feel that one's own stone contributes to building the edifice of the world."*

Entering data into a PMIS may not be contributing to the edifice of the world, but it sure does contribute to the edifice the team is building.

An implementation strategy must include time for training the team—along with a little motivational coaching.

Starting small

But no matter how nimble an organization is, all will invariably suffer when as they install computer systems that automate what has been a human process. There's difficulty while the team adjusts to the new procedures—typically accompanied by grousing from people who resist change. And the grousing is given credibility by the inescapable glitches that are inherent in a system startup.

Consequently, wise managers start small.

It won't happen without the boss maintaining a persistent drumbeat of insistence on accurate online information.

---

[5] Antoine de Saint-Exupery was the author of The Little Prince, Wind Sand and Stars, Airman's Odyssey and many other works. He was a pilot during the early days of aviation, pioneered air mail over the Andes and was lost on a mission in during WWII.

The challenge is people, not technology. A PMIS changes how people do their job. It's a culture shift. That requires executive leadership.

Starting with the projects and the team

A strategy to install a PMIS may be to start with a little data for all the projects, or a lot of data for a few of the projects.

If the former approach is chosen, projects may initially be identified simply by name with information on the team: the people, organizations and their roles. The details of project accounting, schedules and requirements may come a little later.

A clerical person can enter the original data. Then team members can be asked to update their own profiles and project managers can review the project descriptions. Full-blown cost, schedule and quality information is be added as the team is trained and becomes comfortable with the discipline of routine input.

Conversely, if the latter strategy is chosen, the leaders may choose to implement one or two projects that are staffed with pioneers who are enthusiastic about the system and will be patient with de-bugging the processes.

The next step: agreements and document management

Agreement and document management is straightforward and immediately productive because the team learns how to store and retrieve their files centrally instead of keeping a partial, unofficial sub-set of the documentation on their personal computers. They grasp the concept of the PMIS as a central web-based location for managing agreements and the work products that are the fruit of the agreements.

A PMIS is a good place to put a policies and procedures manual. The first step is simply an electronic version of the paper document in one of the folders. That's easy. More sophisticated user-interfaces (pop-up boxes, hyper-links and animation) can be added over time to make the manual more effective. Ultimately, manuals may be adapted into structured process, electronic forms and smart folders.

There are two approaches to implementation:

1. Start with a few modules for all the projects

2. Start with a few projects with all the information modules.

Electronic forms and smart folders

Although electronic forms and smart folders may be part of a PMIS, it's best to get the basics working first. Electronic forms are tough to implement and can bog down a startup procedure.

It's not the technology that's tough—it's the people. When a team begins to diagram a workflow in the level of detail that's required for automation, with all the realistic variations, they discover that what they think is a standard process is not. Five people who routinely implement a process will inevitably describe it differently. Then, if there is a group discussion, they will want to change it. The process may vary by project delivery system, by building type, by the amount of money involved or by the group implementing it. After a process is finally defined, it must consider what happens when people who are part of the process are unavailable. If there is reorganization or someone in the chain leaves, the procedures need adjustment. Defining processes is time consuming, political and a big job.[6] If the process is defined without broad stakeholder involvement, the buy-in won't be there and the system will fail.

In the first phases it's best to maintain flexibility in the system so that people can use their judgment and their knowledge of the process to decide how to route information. It's easier to get going and users are less intimidated. With time, the team can begin to automate information flow—gently.

Resistance

PMIS information is updated by project team members who have defined responsibilities to do so. The program manager must create those responsibilities and enforce them. Some of the team, indeed some of the most experienced and capable members, will see the chore of maintaining the PMIS data as "administrivia." They see project information as power, their turf and something they have always been responsible for. They may see their "real" job in traditional light as managing and meeting with people. The PMIS is treated as an afterthought.

Technical support

Resistance may be a cry for help. People procrastinate when they are unsure how to do a task. Some people can go to a training seminar

Structured workflow with programmed electronic routing of forms provides managers with a tighter control of procedures but it's harder to do that might appear. It should not be part of the first steps in iplementation.

---

[6] There are well-known instances where the installation of a PMIS system failed or was delayed for years because the organization bogged down trying to agree on how they would execute the complex processes that involve multiple people in multiple organizations.

and leave knowing what needs to be done, but most will need additional help. It doesn't work to train everyone once and then move on. Having tech help close by during startup reduces frustration.

Current information

Project managers will delay input if they are unsure of the data and that will cause a problem. Here's a common example: a project executive wants to know if a project is on budget. A quick way to check is to look at the current unused contingency. The executive does so and sees a comfortable margin. But the executive remembers that change orders are in the works. A phone call produces something like:

> *"Oh no, we don't have that much left. When we process the latest set of change proposals we will be down to less than 1%. I am waiting to finalize the numbers until we finalize the negotiations."*

And so the project is in trouble but the PMIS doesn't report it and loses credibility as a current source of project information.

Even though a PMIS will accommodate tentative or "estimated" costs that can be adjusted later, people are reluctant to input numbers until they are final. They are likely to prefer to track project information in their personal computer so they can change the numbers without an explanation to management.

Consequently, the information is stale; data is incomplete; project reports are inaccurate. The misinformation leads to embarrassment and planning errors higher in the organization. The PMIS loses credibility. Everyone must accept the idea that "tentative" and "best guess" information is better than no information.[7]

The boss must persuade, cajole, direct and finally order compliance. A good technique is to conduct open monthly project reviews with the project team, based solely on the PMIS reports. Personal spreadsheets are forbidden. That provides a review for accuracy and gets everyone in the mindset that the PMIS must represent reality.

Handheld connectivity

The proliferation of handheld, telephone computers creates new opportunities.

Some team members will be reluctant to make commitments or enter preliminary information. But a PMIS is collaboration software. It should include commitments, estimates and "guestimates."

---

[7] One approach is to use a "reserve" category. When a financial event is expected, the best guess is entered against the reserve. By using something less final sounding, such as a "reserve," a "best guess" can be corrected when the event (perhaps a change order) is final.

Reports should be formatted and accessible using handheld wireless devices such as a BlackBerry, iPhone or Treo. But what adds even more value than viewing data on a handheld is the ability to collect data—at the source. In traditional workflow information was captured first on paper in the field or in a team member's office, entered into a local computer and then pushed to the central database. Depending on the workflow rules, those steps can take time—perhaps several days. A handheld input device can shorten the process and perhaps provide important early warning to trigger management action.

Interoperability

As an owner begins to implement a PMIS, owner groups and outsourced companies will want to receive information from the PMIS to input into their software. And their software will produce useful information to supply to the PMIS. Everyone will want to exchange data without a new round of data entry. It's bad enough the first time and errors always occur in the duplication process.

Problems with interoperability exist within the owner's organization as well as with outsourced companies.

But each organization will likely have their own software and the software will not be interoperable: the programs don't talk to one another.

So the issue of data transfer among the extended program team (AEs, CMs, constructors) and among the owner's groups (accounting, legal, administration, O&M) will rear its exceedingly ugly head.

Interoperability with outsourced construction organizations

The owner's management team will want to collect data from the AEs, CMs and vendors for the PMIS. But the firms have standardized on different software. To solve this problem, an owner may decree that everyone on the project use the same software. Sometimes that works but it usually meets resistance. Outsourced companies argue that they have company-wide corporate agreements. License fees are spent and their staff is trained to use their chosen applications. Using the owner's software would require new training and new licenses and create cost.

Interoperability within owner organizations

The owner's organization has similar issues. The design and construction leaders want to stay on top of costs, budget work for capital repair and renovation and estimate the cost of potential claims. That information is also needed by the administrative, accounting, operations and maintenance and legal departments. An

obvious thought is that the data should be entered only once for all systems. Not only is it efficient, it's crucial for the PMIS and the other owner systems to agree. If not, executive management in the organization will raise troubling questions.

The Rosetta Stone

Although the software used by an accounting department may not be interoperable with the PMIS software, it's straightforward to write data exchange routines that map and match data fields—as long as the definitions for the numbers are consistent. ("Budget" must mean the same thing to the accountants as it does to the project managers.)

There are no technical reasons why it can't be done. It often is.

When data exchange routines are used there is a common problem when software is updated to a new version. If data fields change, there will be a need to re-map—but that's straightforward too.

Another approach is to use electronic spreadsheets. Most programs can export and import information to common spreadsheets and word-processing programs. The PMIS manager may simply specify a precise set of data fields and provide spreadsheet templates for organizations to populate. Then users may review the information and approve it for input into their database. That saves keystroking. These common spreadsheet programs reside on everybody's personal computer, are well understood and can work as an information interface within the owner's organization and between the owner and the outsourced companies.

However, there is a brighter light at the end of the tunnel. The industry is working on data exchange standards like aggXML.[8] With them, system can transfer data without data mapping. The approach is similar to the standards that allow users of programs like Quicken or Microsoft money to download payment information from different brokers, checking accounts, credit cards, etc.

Turf issues

It's not a technical problem. As data moves from one organization to another, even within the same company, people who are responsible must scrutinize it, approve it and perhaps act on it. The owner's project manager will not allow a CM company to push information into the PMIS without review and approval.

The real challenge is a turf challenge.

---

[8] The agcXML is an Associated General Contractors of America initiative. It is an XML schema's for common transactional data such as standard agreements, schedules of values, requests for information (RFIs), requests for proposals (RFPs), architect/engineer supplemental instructions, change orders, change directives, submittals, applications for payment, and addenda.. See http://www.agc.org/cs/industry_topics/technology/agc_xml

Few CFOs will allow construction professionals to input data directly into their accounting system. They insist (rightfully) on review. A review may be implemented with a structured workflow or with tools that exist within the accounting software. The accounting software may have an incoming information "waiting area" where the information can be reviewed and approved for input. That's good. The attention to detail and accuracy that is characteristic of accountants will be good for the construction professionals who may be more inclined to wag it. Furthermore, some of these groups feel that their data is proprietary. The GCs don't want the owner looking into their databases, and the owner's accounting department doesn't want outsiders having access either.

The owner's project team may be reluctant to provide information to the accounting department. If they are forecasting a funding shortfall or budget issue, they may want to keep it to themselves and try to fix it. If they forecast a healthy contingency remaining on a project they may want to keep it to themselves and use it elsewhere.

There is a timing problem as well. The design and construction group marches to a different cadence than accounting. Information in the PMIS approaches real time. Budgets and estimates start with the facilities group and requests for payments come to the project managers for approval and can be entered into a PMIS promptly and viewed immediately. The design and construction group also monitors the committed costs on a project (e.g., contracts) that typically aren't tracked in accounting. Accounting reports are typically focused on the actual money spent (versus what will be spent), and these reports are usually distributed 2 weeks after the close of a month. That means that data could be 6 weeks old. The operable thought is that accounting reports are history. Construction professionals must look ahead and control events that soon become history.

And so, solving the problem of interoperability between organizations is similar to the challenge of using electronic forms and smart folders. The process must be designed and negotiated providing control to the right people at the right time. The human engineering is more difficult that the technical challenge.