

# FMI Quarterly

2007 ISSUE 4

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**CONTACT US AT:**

**[www.fminet.com](http://www.fminet.com)**

**[quarterly\\_info@fminet.com](mailto:quarterly_info@fminet.com)**

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# This Quarter: Tech Time

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## Dear Reader:

We hope that your year has been a great one and that *FMI Quarterly* has been helpful in achieving those results. It is hard to believe that this is the 25th issue of *FMI Quarterly*, but we plan to be around for a few hundred more so perhaps this is no big deal.

The articles this issue focus on *Technology*. While technology stimulates some of us, it has the ability to outperform Thanksgiving turkey in putting others to sleep. But I don't think you will get the turkey effect from the writers in this issue. Give a few of the many articles in this issue close attention, and I think you will be hooked into reading the rest.

Gayle Sheppard, a long-time friend, has perspective on a new type of software that will quickly capture the imagination of early adopters. Glenn Matteson has rejoined FMI after a 10-year absence. Not only are we happy to have his equipment management experience back in our skill set, we're also happy to have his well-written article on technology impacting field productivity and management. Christian Burger, a former FMI team member, contributes "Software Systems and the Construction Organization," which explores how companies can get more value from their IT investment by changing the way IT is managed within their organization. New to FMI and new to *FMI Quarterly* is Marisé Mikulis. She teams up with Kathryn Robinson to offer an article on reconsidering IT assumptions in order to accelerate its benefits within the construction organization. From our Denver, Colo., office, contributors Sabine Hoover and Nick Schubert provide a thoughtful piece on Building Information Modeling and its ability to push the industry forward. Also from Denver, Ken Roper and Layne Newton pen a piece for us on Intelligent Buildings and related market opportunities for contractors.

Tampa-based, regular contributor Gregg Schoppman delves into the people side of technology, illustrating how contractors can benefit from successful implementation and training.

Also in this issue, we include our leadership team of Vanessa Winzenburg, Tim Tokarczyk, and Willie Hepworth's feature article on trust and its ability to connect people and organizations. Mark Bridgers and Kathryn Robinson collaborate to give us, "Practice Makes Perfect: Best Practices Between Utility Owners and Contractors." Kelley Chisholm provides her annual review of FMI's 2007 *U.S. Construction Industry Talent Development Report* in "Reach for the Stars." Finally, Stuart Phoenix details a number of changes for baby boomers that are making ownership transition more complex.

Some of you are aware of my change in status. For those who aren't, I am following Doc Fails' lead in curtailing much of my travel and client work conjunctive with my 65th birthday. It has been an incredible 39-year experience with a terrific group of clients and FMI associates. For better or worse, however, I will still be at the helm of *FMI Quarterly* for as long as it works for FMI and me. I continue to be fascinated by this great industry of construction, and my editorial role is one way of keeping my hand in the game.

Let us know of topics in which you have keen interest or would like to contribute. We will be dealing with capital innovation, environmental stewardship, globalization, and change management during 2008.

Sincerely,

A handwritten signature in black ink, appearing to read "Jerry Jackson". The signature is stylized with large, overlapping loops and a long horizontal stroke extending to the right.

Jerry Jackson  
*FMI Quarterly* Publisher and Senior Editor

# Departments

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## LEADER AND ORGANIZATIONAL DEVELOPMENT

### Plus/Delta Feedback: A Powerful Tool for Developing People

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Remember the first time you heard your voice on tape? If you are like most people, you were surprised to hear how you sounded. It is often a shock to learn that how we come across to others is not what we thought. Derek, a senior project executive for a prominent construction-management firm, discovered the power of feedback firsthand when he participated in a 360-degree feedback assessment as part of a leader-development program. He was pleasantly surprised to learn that he had gained the highest respect from his co-workers in his technical knowledge, business savvy, and ability to deliver on established goals. He also learned that his style of relating to others had room for improvement. His hard-driving, type “A” personality pushed others away, and he was viewed as arrogant, critical, and resistant to change. He realized that if he wanted to take on more leadership responsibilities within the organization, he would need to grow in his ability to connect with and influence others.

Receiving feedback can be hard to hear, especially if you aren’t used to it. At FMI, we often ask the construction leaders we work with, “How many of you receive too much positive feedback at work?” “How about on areas you can improve?” No one ever answers affirmatively to these questions. It seems many of us are not used to receiving or giving feedback. What about you? What about the people you lead? How would they answer these same questions?

Productivity studies have shown that feedback (positive and constructive) is a key ingredient in improving performance. It is also a powerful motivator for people. In environments where feedback is rare, people are operating in the dark, almost as if they were blindfolded. Many of us have experienced that at some point in our careers — that is, where either the person or the willingness was not there to give us guidance, teaching, and direction. While we may be able to make it through that experience, that’s not the kind of workplace where we perform our best, and it is definitely not the fastest way to learn. Giving feedback is how leaders can turn on the lights for their people and remove the blinders.

Positive feedback remains one of the simplest, cheapest, and most effective ways to reward and motivate people. Saying “thanks” and recognizing efforts goes a long way toward letting people know they are appreciated. Even more important is being specific about what people have done well. Without specific

feedback about what we are doing that is working, we only hit the goal by accident, and we cannot repeat the performance with any predictability. This is what we call “plus” feedback: letting people know, specifically, what behaviors will help them reach the goal. “Plus” feedback (knowing what to continue or do more of) is just as useful as feedback about behaviors that cause the person to miss the goal (things to stop doing).

The other type of feedback involves how to improve performance. What is getting in the way of hitting the goal? We all need to know how we can perform even better, and in this time of

increasing competition, a person or a company that does not know where to improve will fail to learn and will quickly be left behind. We call this “delta” feedback, from the Greek symbol for change. Feedback, whether about behaviors to change or things to continue doing, is essential for any person or company that wants to grow, learn, and succeed. If we assume most people are doing the best they can, then the only way they can improve is to change something based on feedback. Remember the

feedback that Derek received about being critical and resistant to change? With a little coaching, he learned to solicit ideas from others on his team, thank them for those ideas, and to take the time to think through how those ideas might affect the operations of his organization, rather than discouraging innovation by immediately analyzing an idea and explaining why they would not work. Not only did he reap the benefits of having his co-workers begin to see him as more open to change, but he also discovered that they had a lot of useful ideas.

#### **BALANCED FEEDBACK**

Feedback that is always “delta” becomes discouraging and unproductive. We all need to be recognized for what we do well and to learn how we can improve. At the other extreme, if we only receive “plus” feedback, we will never learn how

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to improve. Furthermore, if the “plus” feedback we receive is shallow or just “warm fuzzies,” it does not really improve performance or motivate people.

If our message is going to resonate with the person receiving the feedback, we need to make sure we are specific about what we observe and the impact that the words or behaviors are having. Mark, a senior vice president at a large construction management firm

gave his boss, Erik, specific feedback after observing a pattern of behavior. “Erik, I think you could be even more effective in our management meetings if you leaned forward in your chair and communicated interest by sharing your ideas and asking questions. Although I’m sure this is not the impact you are intending, leaning back in your chair and remaining silent can be

interpreted as being disinterested in the conversation.” Mark’s feedback is specific, behaviorally focused, and informs Erik on how others interpret his actions.

### APPLICATION

Think about yourself as a leader.

- Do you give enough “plus” feedback?
- If not, why not?
- What prevents you from doing so?
- Do any of these reasons sound familiar to you?

“If I give ‘plus’ feedback ...”

- People might relax and give less effort.
- Maybe they’ll ask for more money.
- Their paycheck is their positive feedback.
- Maybe the person will be uncomfortable hearing it.

“If I give ‘delta’ feedback (what needs to change) ...”

- People might get upset.
- It will just start an argument.
- I don’t have time to tell other people how to do their jobs.
- I am not good at giving “delta” feedback.
- They might criticize me.

To reap the most benefit from delta/plus feedback, you should:

1. Provide a balance of “plus” and “delta” feedback, and
2. Be specific in order to motivate people and to gain an increase in performance.

These feedback reminders will help you get the results you want:

- Ask permission.
- Care — be tough on issues, easy on people.
- Have a positive attitude.
- Offer alternatives and suggestions.
- Talk about the behavior, not the person.
- Use “I” statements, not “You” statements.
- Use good timing.



- Consider your location.
- Use simple, direct statements.

Try giving more feedback at work, “plus” and “delta.” You will see an increase in motivation, performance, and learning for yourself. You can also help people be receptive to your feedback by being open and receptive to any feedback you receive. As you give and receive more feedback, you, your team, and your company will all reap the benefits of this high-performance technique. ■

*Tom Alafat is a senior consultant with FMI Corporation. He may be reached at 303.398.7209 or via e-mail at talafat@fminet.com. Peter Nielsen is a consultant with FMI Corporation. He may be reached at 303.398.7257 or via e-mail at pnielsen@fminet.com.*

## MERGERS AND AQUISITIONS

### ABCs

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Most entrepreneurs work their entire career to grow the value of their company. While they often earn a great living, a significant portion of their net worth is tied up in the business. One method of accessing that wealth is to sell all or part of their company.

Since selling a business is usually a once-in-a-lifetime event, entrepreneurs tend to have many questions about the process. Although every company is unique, there are common themes and frequently asked questions, which are summarized in this article.

#### IS THIS A GOOD TIME TO SELL?

The most important timing decision involves a seller’s personal goals. If you are not ready to sell the business, the external environment is irrelevant. Once you have decided that both your financial and personal lifestyle goals point towards selling the company, then it is time to investigate the market environment.

Companies generally sell at a premium, if the previous few years have exhibited growth and the business is still strong. It is much more difficult to achieve a strong sales price if financial results have been declining or erratic.

The economy, in general, will influence cyclical industries like construction, and sales prices generally rise in good times and fall when the economy performs poorly. Buyers are more likely to pay strong prices for acquisitions when their profits are good and their stock price is up.

A long-term plan will ensure you are prepared to market the company in a time of strength, not weakness. Selling a business generally takes nine to 12 months, from the first meeting with your investment banker until the proceeds

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**Thoughtful preparation and planning are key to maximizing the value of your business. Any weaknesses in the business should be addressed well in advance of the sales process.**

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strengths and weaknesses by potential buyers. In general, they are the same characteristics that you look for in a strong business with a long-term focus. Value is enhanced by traits such as:

- Revenue and profitability growth
- Plans to address shifting markets and competitive pressures
- Technology and finance infrastructure
- Customer diversification
- Management depth
- Good working capital management
- Proprietary products or technologies
- Brand awareness/name recognition
- Up-to-date equipment and facilities that can accommodate growth

Conversely, negative results on these traits will detract from the value of the transaction.

External value drivers are those that are completely outside of the company's realm of influence but will still affect the value of the business enterprise such as:

- Market trends
- General economy
- Industry consolidation

Sophisticated buyers will ask the right questions to understand the true state of your company. If the value drivers/detractors are ignored by the business owner, they will surely be a focus of the potential buyer. The buyer will have to address your company's weaknesses by spending their own cash, which will affect the purchase price. If you are already a strong organization that is prepared for growth, you will be a better investment and command a higher price.

of sale are wired into your account. You want to be prepared to pull the trigger when the company is in growth mode, and the sector and economy are doing well.

#### **HOW DO I PREPARE MY BUSINESS TO MAXIMIZE VALUE?**

Thoughtful preparation and planning are key to maximizing the value of your business. Any weaknesses in the business should be addressed well in advance of the sales process.

If you think you will want to sell the business in three to five years, start preparing now. The terms "value drivers" and "value detractors" indicate the characteristics of your business that will be viewed as

**WHAT IS “PRIVATE EQUITY?” WOULD  
A FINANCIAL (PRIVATE EQUITY)  
BUYER/INVESTOR BE A GOOD FIT FOR  
MY COMPANY?**

Private equity firms manage pools of invested money from private individuals, pension funds, insurance companies, endowments, and other investors. Private equity firms invest in companies using financial leverage, with the goal of growing the company, paying off its debt, and realizing a return far in excess of what traditional investments generate.

Private equity has grown immensely in popularity as an investment vehicle in the past five years. Due to the amount of funds available for investment (estimated at more than \$100 billion), there is a great deal of competition for acquisitions of middle-market companies. In this unique environment, private equity purchasers are paying prices that are competitive with strategic (industry) buyers, and often pushing prices higher than would be possible, if only those strategic buyers were interested.

Private equity firms generally purchase majority stakes in companies, ranging from 51% to 100% of the equity. In general, private equity buyers want active management to remain with the company for at least two to three years after the transaction. The more active others are in running your company, the less emphasis will be put on you to remain with the company post-transaction. In

general, the seller/owner will receive administrative and planning support from the private equity partner, which allows him or her to devote more time to the part of the business that he or she enjoys.

Many entrepreneurs choose the opportunity to sell a large portion of the company to diversify their wealth, but still retain a significant percentage of equity so that they can participate in the upside as the company's success continues. Private equity buyers generally prefer to structure deals in this manner. When the company is sold for the second time (typically three to seven years later, and hopefully at a much higher value), the remaining equity is cashed-out in what is commonly referred to as “the second bite of the apple.”

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### IF I WANT TO STAY, WILL THERE BE A PLACE FOR ME AT THE COMPANY AFTER A SALE? WHAT WILL MY LIFE BE LIKE WITH A “BOSS?”

The spectrum of buyers will range from large companies that have managers cued up to run the company after a transition period, to investors that want you to stay for three to five more years and continue to grow the company. Ideally, you will attract interest from a buyer whose post-transaction expectations match yours. However, flexibility on your part is always the best tool to secure the strongest financial deal. You can often maximize value by compromising your ideal transition.

Many entrepreneurs dread the idea of having a boss. After many years of controlling your own destiny, it is difficult to play second fiddle. Creating a new position, expanding into a new geography or purchasing a major piece of equipment may have been your unilateral decision before sale of your business. While you may have similar authority delegated from your new boss, it is more likely that some new rules will be put in place. With a strategic acquirer, you will likely be part of a large company and have to play by their rules and accept their corporate

culture. The flip side is that you always have the freedom to move on, if you are not happy. With a private equity buyer, you will likely have a great degree of autonomy as long as things are going well. However, if sales and profits are suffering, you will certainly know that you have controlling shareholders to answer to.

It is always wise to speak with former business owners that have been acquired by your buyer. They will have excellent insight into what your life will be like as part of the organization post-close. Many

entrepreneurs find long-term happiness partnering with their acquirers, but some need complete control to be happy. You should learn as much as you can about your acquirer, and be as honest as you can about yourself and your need and desire for control.

### WILL MY CUSTOMERS AND COMPETITORS FIND OUT THAT MY BUSINESS IS FOR SALE?

The construction industry is a small world and many of the participants know each other. For this reason, most of our clients are concerned about confidentiality during the sales process.

There are certain measures that your investment banker should take to protect confidential information, including the identity of your company. First, your investment banker should not contact anyone without your approval. Second, your banker should have potential buyers sign confidentiality agreements before learning your identity or any significant details about your business.

However, there is always some risk that others will learn of your impending sale. While it can be minimized, risk of disclosure is one that you must unfortunately take in order to sell your company.

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**The construction industry is a small world and many of the participants know each other.**

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## WHEN SHOULD I TELL MY EMPLOYEES? WILL MY EMPLOYEES LEAVE, IF THEY FIND OUT MY BUSINESS IS FOR SALE?

You can decide when to give employees knowledge of the transaction. Some sellers tell their top managers before the process even begins, and others wait until after the final sales agreements are signed. Business owners are seldom comfortable in making a pending transaction public. However, sometimes the downside of telling key employees is less problematic than the difficulty of completing the sale process without their knowledge. Often, key employees will be included in the process early, but other employees will not have any knowledge until late in the process or until after close.

By nature, most people are uncomfortable with change. Word of a pending sale does create an uncertainty for employees that will make many of them nervous about their future. However, in most cases, good employees will have greater opportunities after a sale as part of a larger organization. Also, in the case of a financial buyer, your employees will be valued since they helped create the success of the company. At an appropriate time, you can communicate to your key employees this fact. You can also emphasize that they will likely benefit from greater career opportunities as a result of the sale. Be as specific as possible without making guarantees that you are in no position to make.

Entrepreneurs spend many years building a business. Mistakes are made along the way. Lessons are learned, and eventually, business owners have an excellent grasp of their capabilities and their markets. Selling a business is typically a one-time event, with many facets to consider. It can seem a daunting event by even the most optimistic business people since it is a completely new endeavor and often outside their comfort zone. However, it has been done thousands of times, and countless entrepreneurs have dealt with the same difficult issues. At the conclusion, they reap the reward for decades of hard work building their business. ■

**Scott Patten** is a senior associate with FMI's Investment Banking Group. He may be reached at 303.398.7202 or via e-mail at [spatten@fminet.com](mailto:spatten@fminet.com).

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**Selling a business is typically a one-time event, with many facets to consider.**

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## MERGERS AND AQUISITIONS

### Exit Options for Owners: A Checklist for Selling Your Company Internally

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The recent strength of the U.S. commercial and institutional construction marketplace has provided a boost to the coffers of many contractors. Flush with these strong profits and record backlogs, many owners have begun to consider the next logical step — exiting their business through a sale or transfer. While the flurry of strategic and financial buyers who have emerged for construction

companies in recent years has created mergers and acquisitions opportunities in our industry, the fact remains that the overwhelming majority of contractors (six out of 10) still cash out of their businesses through an internal sale to key employees or family. Whether you are contemplating an immediate internal transfer of your business or have the luxury of time to plan for such succession, this article lays out the key items to examine when considering a sale to key employees or family.

**Align future ownership with future management responsibility.**

The most successful internal sales occur between owners and those individuals who have a direct impact on the day-to-day operations and profitability of your firm. As an owner, you understand the direct correlation between ownership and accountability within a closely held firm — your plan should create and harness this powerful link for application to others.

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**Internal sales are much more likely to succeed when shared goals drive the process and transaction structure, rather than the other way around.**

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**Goals and objectives come before structure and price.**

Shared goals that are openly communicated among participating parties are critical. Ensure that the future owners of your business each have similar objectives with regard to managing operations, building equity, and distributing earnings. Once this foundation has been laid, your advisor can assist in selecting the right structure (ESOP, subchapter-S buyout, permanent joint venture etc.) to meet these needs. Do not try and fit your internal transfer process

into an existing structure just because that is the method you are most familiar with. Internal sales are much more likely to succeed when shared goals drive the process and transaction structure, rather than the other way around.

**Prepare for that which cannot be anticipated.**

Just like in constructing any project, internal sale plans invariably encounter unanticipated bumps in the road — both bad and good. Bad jobs, bonding constraints, unforeseen market opportunities — none of these can be planned for but will likely occur during the course of your ownership transfer. Build flexibility into your plan to accommodate the necessary course corrections.

**Profitability is critical.**

Your employees likely do not have the financial resources available to purchase your company so most of the money will come from the future profits of the business. If your company is profitable, almost any internal transfer technique will work. If your company does not make money, ownership transition will not take place unless you are willing to give your company away.

**Align strategic and ownership transition objectives.**

Cautiously approach strategic initiatives with an eye towards your long-term ownership transition goals. A timely ownership transition will likely impose cash-flow constraints on your business that can limit strategic objectives. Before your transition plan begins, ensure that your strategic objectives align with your ownership transition objectives.

**Company value is based on earnings and your exit timeframe.**

The earnings capability of the business and your timeframe for exiting are far more important than any theoretical value of your business. You may value your company at \$1 million, but this valuation is meaningless if there are not interested outside buyers and your employees are only able to pay you \$500,000 over the timeframe you have set for the buyout.

**Internal buyouts extend the length of your payments.**

Financially, the difference between selling your company to a third party or selling to key employees is often a matter of the timing of the payments — internal buyouts take longer to achieve the same value. However, while value can be roughly equivalent between the two transactions, it is important to recognize that the extended timeframe associated with an internal sale also extends your personal liability as it relates to the company. Depending on your financial goals and the profitability of your company, a smooth internal transfer will likely take seven to 10 years.

Owners who choose to sell their companies to key employees or family have personal motives, which are frequently as compelling as their financial objectives. They may take pride in seeing their names remain on the door, giving their children or loyal employees a chance to own what they do, or in providing continuity of a unique corporate culture. The attractiveness of the internal sale process is that it offers owners a great deal of flexibility with regard to roles, responsibilities, compensation, and other deal components.

An internal sale to key employees or family can be a rewarding alternative for all parties. With the strength of the current construction economy, the climate has never been better for developing an internal ownership plan. ■

*Timothy Szniewajs is a consultant in FMI's Investment Banking Group. He may be reached at 303.377.4740 or via e-mail at [tszniewajs@fminet.com](mailto:tszniewajs@fminet.com).*

## ZURICH CONSTRUCTION

### BIM Technology Benefits Outweigh the Risks

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As the latest technological advance to hit the architectural, engineering, and construction industries, building information modeling (BIM) is expected to become the design tool of the 21st century, completely changing the way business is done.

A departure from the computer-aided drafting (CAD) methods in common use for the past 20 years, BIM gives users the ability to demonstrate the entire building lifecycle, bringing an unprecedented collaborative approach to the

process. Using data provided by virtually every member of the project team, BIM uses 3-Dimensional digital representation that allows computers to “virtually build” the project — from viewing, testing, and revision, to generating reports and views for purchasing, fabrication, and assembly operations — avoiding paper altogether, in most cases.

Users believe BIM’s main advantage is error reduction, along with increased construction productivity and shorter construction time, all of which directly contribute to cost savings. Specifically, BIM can reduce errors through computer visualization of a building’s components in relation to the whole project, giving team members the opportunity to detect and fix conflicts before construction begins.

This early detection can translate to big savings for the industry. According to the American Institute of Architects, it costs \$100 billion to fix and administer construction errors vs. \$24 billion to design the original projects. Much of this waste or rework is due to inaccurate drawings, miscommunication among stakeholders, and inefficient and inconsistent design analyses, according to the National Institute of Standards and Technology (NIST).<sup>1</sup>

Like any tool still in the developmental stages, BIM is far from perfected. Because the technology itself is still evolving, team members frequently end up using a variety of versions and applications, most of which don’t interface with each other. Others are reluctant to make the transition from CAD to

BIM systems.

Another concern is how BIM will change the face of construction contracts and legal liability. Because so many different users are directly inputting data into the system, the gatekeeper role is still unclear, which is a serious concern when the input and handling of so much data is at stake.

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**Like any tool still  
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#### FROM CAD TO BIM

Twenty years ago, the design and construction industry began moving from drafting tables and blueprints to CAD technology, which

automated the drafting process. CAD computer applications are based on traditional 2-Dimensional representations, using lines, arcs, and symbols. Because personal computers were just becoming universally accepted, the timing was perfect for the emergence of CAD in the industry.

The later development of 3-D and object-oriented CAD (OOCAD) systems



eventually replaced 2-D symbols with objects representing the behavior of common building elements, all displayed in multiple views.

BIM technology, which began taking hold in the United States around 2000, traces its roots to OOCAD and is actually the latest generation of CAD technology. The big difference is that BIM bridges the information loss associated with a traditional building project by enabling users to input all the elements that combine to make up a building design into one “project database” or “virtual building” — a single, consistent source of information associated with that building.

BIM involves collaboration by everyone in a construction project — from the design team (architects, surveyors, civil engineers, structural engineers, mechanical engineers, and electrical engineers) to the construction team (contractors and subcontractors) and building owners/operators — allowing each group to add to and reference back to all existing information. Users say that it is this collaboration that makes BIM so beneficial.

Leading BIM software products include Vertex BD from Argos Systems Inc.; ArchiCad from Graphisoft; Bentley Architecture from Bentley Systems; Revit Architecture from Autodesk, which recently purchased competitor NavisWorks; and SketchUp from Google.

#### EMBRACING THE NEW

Many larger design and construction businesses impressed by BIM’s capabilities have embraced the technology over the past several years.

“Seeing a project in 3D was a huge first step in the right direction,” said Michael LeFevre, AIA director, planning, and design support service for Holder Construction in Atlanta, which has been using various BIM formats since 2003. “Everyone being able to see it together was another huge benefit in gaining a better understanding of the building and of each other. Finally, having all the data in one place, current, and being able to extract intelligence from it is another bonus.”

Firms like Holder are so sold on BIM that they have designated specialists to oversee its implementation. An example is Karie Johnson, director of virtual construction at Adolphson & Peterson Construction in Minneapolis, which began using BIM technology about a year ago. Johnson’s job is to integrate BIM into her company’s processes by introducing the technology to all offices nationwide, overseeing training and product purchases, and working with team members to determine which construction projects warrant the application of BIM and to what degree (the company only uses BIM for more complex projects that lend themselves to partner collaboration).

“BIM is revolutionizing the way we work together,” Johnson said. “Since it changes the way we interact with each other, it requires a level of trust due to

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**Many larger design and construction businesses impressed by BIM’s capabilities have embraced the technology over the past several years.**

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current contracts and liability issues.” An architect by training, Johnson lauds BIM for its reduction of rework, waste, and expense, and its increased accuracy, productivity, overall project understanding, and advanced safety.

Companies already using 3D CAD technology find the transition to BIM a relatively natural progression. “Right now, we’re going through the same thing with BIM that we did with CAD in the mid-1980s,” said Dan Russell, simulated construction department manager at Sundt Construction based in Tempe, Ariz., a BIM user for about 18 months. “The biggest issue is getting people up to speed with training and struggling through a temporary loss in productivity as they get used to a new system. But the benefits far outweigh the upfront costs.”

#### REAL-LIFE EXAMPLES

For Michael LeFevre of Holder, BIM has proved invaluable by producing 3D models for partial use on buildings in a matter of hours or days, compared to a year or more with a traditional CAD system. Model creation and maintenance costs associated with BIM use range from hundreds of dollars to six figures, with an immediate return in direct collision detection cost avoidance anywhere from two to 10 times the model’s cost. “This estimate doesn’t even begin to measure indirect savings such as shorter schedules, reduced conditions costs, avoided cost escalation, owner and construction team rework, contingency management, and claims reduction,” LeFevre added.

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**Companies already using 3D CAD technology find the transition to BIM a relatively natural progression.**

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Holder recently invested \$40,000 to model a downtown Atlanta project on a tight urban site. The firm realized cost savings of \$200,000 by using BIM technology, LeFevre said. The savings came in the form of avoided building conflicts, such as mechanical, electrical, and structural problems — beams colliding with ductwork — that did not show up in 2D.

Another recent BIM-modeled Holder project in Arizona resulted in no mechanical collisions — a rarity in the traditional design and construction process. “We’re human, and only as good as our minds and flat paper,” LeFevre said. “While this tool still requires good experienced professionals, the use of 3D conflict detection tools makes us much smarter — and smarter together.”

Karie Johnson recently used BIM technology for a 3M film-processing plant

in Greenville, S.C., a \$45 million job. Using BIM allowed the team to show subcontractors what the building was going to look like, giving them a clearer understanding of the scope of the project, and lowering bids. The technology also made it much easier for the Minneapolis team to work with equipment manufacturers in Germany.

For Sundt, BIM has already saved the firm big money by avoiding building collisions, said Dan Russell. While modeling a wastewater treatment plant, the firm found areas where the building's underground piping was hitting the electrical duct bank. The project team made changes to the duct banks before starting construction, resulting in savings totaling \$250,000 in hard costs.

On another project modeled using BIM, Sundt spotted problems with a mechanical room that was too small to accommodate heat exchangers and other large equipment. An option was to lower the floor, which wasn't an issue because the problem was detected before construction began. However, the project's mechanical engineers wanted to know why the heat exchangers were so large. By using BIM, the team was able to see the issues and the mechanical engineers recalculated the requirements. They then specified smaller heat exchangers before starting procurement, which meant they were able to fit everything in the mechanical room without lowering the floor.

#### POTENTIAL FLIES IN THE OINTMENT

With all these benefits, it would seem there are no drawbacks to using BIM technology. However, a few areas of concern do exist.

First is the cost of such systems. "Like any technology investment, a significant initial outlay is required to get up to speed," Johnson said. "A system to implement BIM can run upwards of \$10,000 to \$20,000 for one user, plus training costs. However, if a person has an aptitude for computer technology and 2D skills, it is not too difficult to make the leap into 3D."

Lack of systems compatibility is another issue for users. In 2004, the NIST estimated that the U.S. capital facilities industry loses \$15.8 billion annually from inadequate interoperability (the exchange of modeling information between various disciplines).

According to the National BIM Standards Project Committee (NBIMS), the fragmented nature of the industry is the result of the old artisan hierarchies, and later trade union practices, which were eventually codified in legal and ethical separations between designers, construction, vendors, and end-users. Even when the industry began using CAD technology, business practices were still compartmentalized.<sup>2</sup>

However, NBIMS, along with other industry groups and the federal government, are currently developing BIM national standards. The industry is currently commenting on *National BIM Standard Version 1, Part 1*, with Part 2 estimated for publication at the end of 2007.

## THE IMPACT OF LIABILITY

The other major area of concern surrounding BIM use is how the construction contract will respond to the technology — specifically, how the industry will adapt to a 3D model as a contract document and how it will affect liability exposure.

Currently, a construction project's architectural drawings represent the construction contract, which has remained virtually unchanged for many years, said Jim Bedrick, vice president of virtual building and design for Webcor Builders Inc., San Mateo, Calif. "While there is no doubt that 3D models do a much better job of representing work than 2D drawings, the question is how to make the 3D model into a legal definition of the contract requirements," he said.

"What we are currently seeing with BIM is the typical signoff document language we saw when AutoCAD was first introduced," added Karie Johnson. "Information is shared but with a disclaimer."

Much will depend on interpretation, with the need to make a distinction between simple project information and actual contractual requirements, Bedrick added.

A related question that must be answered is: Who is ultimately responsible for the information going into the BIM model? "Because BIM has enabled a more collaborative process, various organizations are looking very hard at the whole design and construction process, which should be, and now could be, much more integrated," Bedrick said. "Organizations like Associated General

Contractors, American Institute of Architects, and the Construction Users Round Table are looking into what contracts will look like when we have an integrated delivery process."

Integrated agreements are nothing new in Europe and abroad. For example, Australians have used project alliances with legal contracts for years, with 35 to 40 major infrastructure projects built under these agreements in the last several years, Bedrick said. However, this is still somewhat of a revolutionary process in the United States.

One of northern California's largest healthcare providers, Sutter Health, recently used integrated agreements.

The company is embracing a new construction philosophy to execute approximately \$6 billion in capital projects over the next several years. Sutter is using Lean Project Management, which is noted for greater planning and communication, better workflow, fewer change orders, and prompt material handling.

The downside of such collaborative projects is a blurring of liabilities, which can result in confusion around project insurance, Bedrick noted. Traditionally, all contracts are written by compartmentalizing risk, which made it easily insurable. Under this process, architects and engineers carry errors and omissions insurance, while the contractor does not. Under a collaborative system, this distinction is not as clear.

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**A related question that must be answered is: Who is ultimately responsible for the information going into the BIM model?**

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However, risk management is much improved through collaboration, making it more attractive to insurers, Bedrick noted. “If you have a designer and builder working together, you have a much better chance of controlling the risk on a project,” he said.

While all of these factors may cause users to give BIM technology a second thought, it would not be a good idea to stay off the BIM bandwagon, said Sundt’s Dan Russell.

“Experts are predicting that BIM will be the industry standard within the next five years,” he said. “Two years ago, maybe 10% or 20% of architects were thinking about it. Today, in larger firms, about 80% are using it in some fashion. Even the AIA has said that, if you’re not using BIM in the next five years, you’ll be close to being out of business.” ■

**Jacobus Vroljik** is vice president in the specialty products division with Zurich’s construction business group. He may be reached at 952.229.3622 or via e-mail at [jacobus.vroljik@zurichna.com](mailto:jacobus.vroljik@zurichna.com).

<sup>1</sup> Julie Fraser, Executive brief: Leveraging the value chain in construction — Building Information Modeling (BIM) [http://64.233.169.104/search?q=cache:7qGf174mDsJ:https://www304.ibm.com/jct03004c/businesscenter/smb/us/en/contenttemplate/!/gcl\\_xmlid%3D41848/+American+Institute+of+Architects+%24100+billion+construction+errors+%2424+billion&hl=en&ct=clnk&cd=1&gl=us](http://64.233.169.104/search?q=cache:7qGf174mDsJ:https://www304.ibm.com/jct03004c/businesscenter/smb/us/en/contenttemplate/!/gcl_xmlid%3D41848/+American+Institute+of+Architects+%24100+billion+construction+errors+%2424+billion&hl=en&ct=clnk&cd=1&gl=us)

<sup>2</sup> NBIMS Publications and Resources <http://www.facilityinformationcouncil.org/bim/publications.php>

# Laptop Meets Bulldozer

Implementation and successful training on a single strategically viable tool connected with a fundamental business process creates brawn that will create the engineering marvels of tomorrow.

*By Gregg Schoppman*

**M**any of the engineering and architectural marvels in the world are attributed to construction brawn and muscle. Mighty pieces of iron moving mountains of earth and enormous tower cranes silhouetted on the horizon serve as visual reminders of the enormity of the construction process. Innovations in equipment and building materials have enabled improved efficiency in every facet of the business world as well as made feasible some of the greatest feats within the construction industry.

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However, truly improving productivity in operations requires more than a sophisticated scraper, bulldozer, or drill. Technological innovations on a smaller scale, from laptops to GPS, often have the greatest impact. The challenge for construction firms, small and large, is introducing a culture of technology to people that don't perceive its need or embrace it. The construction industry remains late to the starting block in the technology race, encumbered by complex issues and poorly equipped users.

Software firms abound with solutions to construction's ever-increasing list of demands. Document control, scheduling, collections, and even grade control are a short list of management functions reduced to mere keystrokes and dashboards, all with the intent of improving productivity and increasing efficiency. The main

challenges lie in human elements. The greatest systems are useless in the hands of the neophyte. Capitalizing on technological assets not only enables market differentiators but also increases efficiency at many levels within the organization. Yet, “I don’t know even where the ‘ON’ button is,” is a common retort among many field managers who have dedicated their lives to moving dirt or installing drywall, but place little regard on a 10-pound paperweight (i.e., laptop computer) and the myriad of programs that exist inside. Even with the most experienced user, technology is diminished if it serves as a reactive mechanism to a problem or challenge. Simply increasing functionality of technology will not produce the greatest gains. The long-term solution involves creating a culture of proactive communication and planning rather than speeding up reactive e-mails or lowering the cost of hand-held, two-way radio chirps signaling another firefighting episode. Best-of-class contractors gain maximum efficiency from their teams through a comprehensive and detailed strategy for deployment of technology, no different than introducing a new safety or quality control program. These same contractors understand the value of training and how to integrate these new systems into their operations with maximum effect.

#### A STRATEGIC PERSPECTIVE

Countless numbers of contractors invest large sums in their information technology purchases, yet experience buyer’s remorse when the promised solutions to the project challenges remain elusive. They believe they have been over-promised and underserved. Contractors often brand themselves “early adopters” because they are quick to own the latest and greatest gadgets, yet they have little regard for or knowledge of how to use them effectively. Technology decisions are no different than fleet decisions or tool-crib decisions. Purchasing tools and equipment requires judicious care to ensure they meet the buyer’s desire, form, and function. For example, you wouldn’t buy a rotary drill when a circular saw will do. Further, expensive fleet purchases require even more care to ensure effective and productive long-term utilization. One major challenge with information technology purchases lies in the fact that owners must determine what will successfully integrate and link their legacy

systems while creating a new platform to deal with the current and future challenges. Salvaging an excavator is relatively easy. Salvaging an antiquated document control system requires much more effort to protect the integrity of the information warehouse. Can the new system mirror the old way while providing sufficient innovation for future operations?

Contractors labor over the “biggest and best” systems, hoping to find a fully-integrated solution to suit

their needs that doesn’t require any adjustment of input or output. Alternatively, the cobbled-together systems that support operations seldom operate seamlessly — scheduling by Brand X, cost control by Brand Y, and document control via a complex series of spreadsheets and databases. Even with this “patchwork quilt” approach to

information technology solutions, the technology is often under-utilized. In many cases, the technology available vastly surpasses many contractors' needs. To arrive at the best solution, consider the strategy of the organization. What does the vision of the organization say about the size, complexity, delivery methodology etc. of the projects to be served by the technology? The tools needed to support operations will vastly differ if the firm is dedicated to mass earthwork projects vs. multi-story condominium projects. While the software and platforms may be similar, the utilization of the tools will be drastically different. There is no "one size fits all" perspective. Force-feeding a system or tool on operations people who fail to understand and support that system will only lead to discontent and an underutilized investment.

One of the best techniques for determining the correct system is a focus group of managers and superintendents. This group understands their own needs and what will improve the planning, communication, and efficiency for the type of construction projects the firm undertakes. Their perspectives and early involvement are vastly superior to a decision-making team largely populated by information technology or accounting staff. Exhibit 1 shows how the areas of focus addressed by the typical focus group can vary by type of work.

Exhibit 1

### Two Perspectives of an Operations Technology Evaluation

Sitework/Utilities Specialty Contractor

Customer type: Private, negotiated

Project type: Large scale, earthwork residential subdivision

Operations Area	Level of Sophistication	Areas of Focus
Scheduling	Medium	System needs to focus heavily on manpower and equipment utilization (resources)
Document Control	Low	Simple tool to manage surveys and reports to the customer
Feedback and Cost Control	High	Imperative to receive daily production and unit-cost information; graphical feedback preferred

Commercial General Contractor

Customer type: Public, hard-bid

Project type: Large scale, complex school/municipal projects

Operations Area	Level of Sophistication	Areas of Focus
Scheduling	High	System should allow detailed task-work breakdowns as well as reporting functions for project status; resources will be mainly subcontractors; project task lists anticipated to be 300+ for any given project
Document Control	High	Heavy reliance on written communication (i.e., requests for information, change order proposals etc.) with tracking functions; management dashboard a plus
Feedback and Cost Control	Medium	Impetus is less on daily production (subcontracted) and more on cash flow; heavy importance on change order management (with customers, with subcontractors)



Buy-in to the system begins in the focus group. Without consensus, support, and reinforcement of standards through compliance audits, managers and superintendents gravitate towards their own ad-hoc systems. Instead of using scheduling software to

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## Identify the right team with which to begin implementation, and begin with a new project.

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aid in managing complex activity streams, superintendents use whiteboards and spreadsheets to illustrate a progress schedule. In lieu of GPS systems for grade control, costly survey crews roam the project site. Without pervasive use of the technology, the return on investment never occurs. Furthermore, as operations personnel rely on their own systems, data and project-critical information becomes fragmented and inconsistent. Additionally, important project metrics such as change order approvals, schedule performance, and

status of receivables lack integrity and credibility. Gain a better understanding of how to maximize the system's implementation by examining technology challenges from user perspectives.

### FOCUS ON THE CHAMPIONS

Even with needs clearly identified, implementation requires patience and careful selection of first-users. Many firms have failed at this stage because senior management doesn't effectively roll out the system and provide real-life demonstration of its benefits to their team. The "buy it and they will use it" strategy only caters to a small percentage of early adopters who need little motivation to use new technology. Early adopters are important, however, as the "champion group" that will help endorse and sell the system to the rest of the organization.

Identify the right team with which to begin implementation, and begin with a new project. Before beginning the project, develop the project infrastructure with the team. The "pilot study" enables the firm to examine the most efficient methodology moving forward by providing a test case for file trees and budgets. For example, the list below identifies some project components and aims to surface corresponding logic through team development:

- **Documents:**

- Requests for Information*

- Numbering system for quick reference
    - Field generated vs. office generated?

- Letters*

- File by issue vs. file by entity (i.e., subcontractor, customer etc.)
    - System generated or word processing program?

- Submittals*

- Numbering system
    - Appropriate dashboard for submittal status

- **Schedules:**

- Typical Work Breakdown*

- By phase, location etc.
    - Level of detail?

- Resources*

- Master resource list vs. independent resource list?

- Cash Flow*

- Task revenue, task costs, both?

- **Job Cost Feedback:**

- Budget Set-Up*

- Logical sequence of coding?
    - Appropriate number of codes?

- Tracking and Feedback*

- How will status be reported?
    - How will performance be communicated?

While many of these questions may seem intuitive, pilot groups help create continuity as new project teams adopt the new systems. Debugging the system continues long after the software leaves the factory. Customizing reports and project infrastructure early at the project level creates a stable foundation for future projects. More importantly, this provides a “grown here” feel rather than the generic, one-size-fits-all quick fix.

The momentum generated by this group of champions helps sell the next group as well as dissuade dissent from would-be system saboteurs. While information technology is largely a hard science, successful use of technology relies, in part, on the psychology of thwarting those who would derail the implementation. Reasons for non-acceptance range from lack of training to simply a general ignorance of system benefits. When champions extol a system’s virtues and celebrate early successes, fence-riders can be recruited to the enthusiastic user-side. Associates visualize the benefits of a system rather than view it as a hindrance. Thus, arguments of the assassins and saboteurs lose credibility.

## MENTORING AND TRAINING

The next challenge is to deal with novices, potential naysayers, and assassins. Companies routinely invest in basic computer training. These courses offer a fundamental knowledge of how to turn on the computer and access the Internet. Long after the course ends, many questions still linger. Admitting defeat to a nine-pound laptop is almost non-existent in the macho and ego-driven world of the contractor. Instead, the laptop sits in the trailer or on the passenger seat of the truck, unused. The loss associated with the cost of a wasted computer pales in comparison to the losses in productivity whether it is from the job-cost feedback system or

simply in the communication bottleneck this non-use creates.

As companies deal with these technological issues, their organizations get older. Across the country, companies struggle to meet industry demands because of a lack of skilled labor brought about by the aging workforce. A great divide exists — younger project managers and engineers are married with older field managers and superintendents. These odd-couple teams are enlisted to complete complicated projects with significantly different perspectives and skill sets. How does an organization create synergy and a productive environment with a team that sees the project from two different extremes? Senior management's challenge lies in bridging the gap between a group that embraces technology and a group that views technology as an impediment to building. Mentoring is one technique for creating a proactive training environment that allows both groups to benefit.

As older members of the team retire, companies not only lose an employee but a knowledge asset that is difficult to replace. Capturing that knowledge is paramount. Further, another source of pain in many organizations stems from younger managers and engineers who lack the necessary field knowledge to make educated and informed decisions about their projects. Great companies insert new associates directly in the field. Rather than learning office skills first, they begin by learning critical field and constructability lessons from the field manager. It is here that a symbiotic relationship can develop. Most of the younger associates flourish in a technology environment, stemming from their education and upbringing. By imparting their skills and supporting the field, both people learn and the project's performance increases as well. Careful explanation of the benefits of such a pairing needs to take place early on in the process. Pairing the right individuals together is equally important. Thrusting a

young engineer or assistant onto the site of a lone-wolf, curmudgeon will frustrate both parties and provide limited educational opportunity. A structured process and proactive communication help create a strong farm system of future producers as well as a means of teaching the old dogs some new tricks.

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**Most of the younger associates flourish in a technology environment, stemming from their education and upbringing.**

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#### **OVER-RELIANCE ON TECHNOLOGY**

Web-based this, hand-held that. Cell phones now receive e-mail, voice mail, and basic cable television. The capabilities of some scheduling software surpass the needs of many contractors who simply

want to create a bar chart. Technology offers many opportunities, but without strong fundamentals, it will never be the panacea construction executives desire.

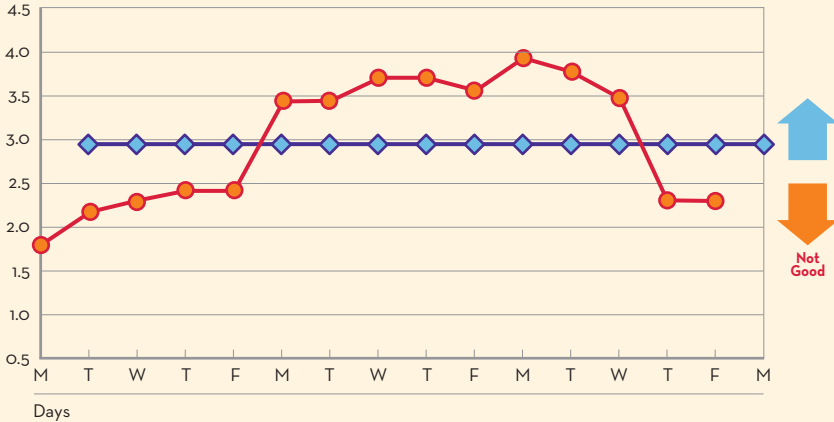
For example, wallpapering trailers with grandiose Gantt charts is no substitute for good quality planning. A computer will never download the thought process of a project estimate or the best strategy with which to construct a project. A schedule is a piece of paper. Planning requires thought and interaction. Without fail, ask a project manager or superintendent about their plan, and you will be handed a bar chart. Efficiency and productivity increase not because of the bandwidth or an Internet

Exhibit 2  
**Performance Feedback: A Graphical Perspective**

Average Daily Production

◆ Estimated daily production  
 ● SQS/man day

Production (SQS/Man Day)



connection or number of tasks on a Gantt chart, but rather because teams have engaged in the appropriate level of planning before, during, and after a project.

Voluminous cost reports teaming with columns of data never serve their role if they are neither shared nor understood by the intended audience. Green bar sheets often litter the landscape of a trailer with critical production information going unread. Knowing the score provides the field critical information about their performance so they can take corrective action. Management needs to be sure the information distributed speaks to its audience. Provide meaningful graphical feedback on performance. Pictures sell the information better than a tabular matrix and communicate to multiple audiences. Colorful, graphical output is not just eye-candy; it is extraordinarily valuable in its ability to make important points in very little time. Sharing this information with the crew involves the team in the project goals and can drive the right behavior to achieve those goals. Exhibit 2 illustrates this type of performance feedback.

The construction industry relies heavily on the human element. Many industries benefit from such technological innovations as robotics and automation. The integration of man and machine in construction is slowly becoming a distinct competitive advantage for some firms. Those who have found a way to distinguish themselves from the competition by incorporating a technology-now strategy with an effective implementation plan not only eliminate their competition but also enhance their operations through the efficiencies of their system. Technology, from GPS to laptops, need not be limited to the technologically strong manager and superintendents. Nor does technology only have to serve the large organizations. Implementation and successful training on a single strategically viable tool connected with a fundamental business process creates the brawn that will create the engineering marvels of tomorrow. ■

# Leadership 2.0: Building Trust, the Forgotten Application

Trust is the fundamental tool leaders must use to increase the connection with their people, inspire them, and to achieve remarkable business results.

*By Vanessa Winzenburg,  
Tim Tokarczyk, and Willie Hepworth*

**T**he advent of new technologies in the late 20th and early 21st centuries has transformed the landscape of human interaction. The world is smaller now than ever before, and people are more connected than at any previous point in human history. Globalization, for example, has enabled us to outsource non-essential business functions overseas, or to share resources within multinational corporations across borders. The proliferation of cell phones has connected us; workers can now communicate with each other almost instantaneously around the world at the click of a button.

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Further, social networking sites like MySpace and Facebook have brought together millions of people into centralized locations, where access to their lives is open to all. These advances in technology have changed the way businesses operate, which provides both additional tools for leaders, as well as newfound obstacles to developing trust with their people. To truly increase the speed and efficiency of their organizations, leaders must be careful not to overuse technology, but instead, to develop a trusting culture.

## VIRTUAL CONNECTIVITY

With technology improving and increasing exponentially, we are living in times unlike any before. The world will only continue to grow smaller as technology becomes more powerful, cheaper, and more readily accessible to the billions of people living in the Third World. In fact, the wireless communications industry grossed over \$115B in 2006, with just 9% of that revenue attributable to North American users. Eighty-five percent of cell phone users currently reside in Asia, Europe, the Middle East, and Africa.

Technology has dramatically increased the quality of life around the world. The Internet, along with e-mail and instant messaging services, enable citizens of countries around the world to become citizens of a global community. Advances in medical technology have greatly improved the quality and length of life for millions of people around the world. Faster and easier access to a wealth of information has transformed education as people have more options and resources for learning. All of

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**The Internet, along with e-mail and instant messaging services, enable citizens of countries around the world to become citizens of a global community.**

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this communication comes at little cost today. Internet-based telephones have allowed people separated by thousands of miles to stay in touch at virtually no cost. Social networking sites have provided a forum for many people to reconnect and to build connections with people they would not have met otherwise. Technology has provided an economic boom to countries like India and China, opening opportunities for education and commerce, and greatly increasing the economic fortunes of many of these countries' citizens.

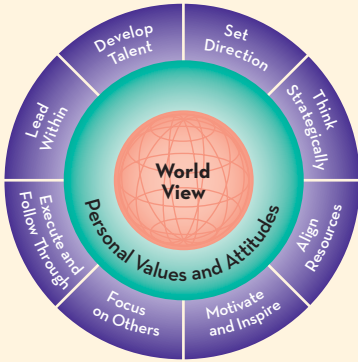
Paradoxically, at the very point when humanity is more connected than ever before, people around the world are feeling more isolated and alone.

In the United States, depression is on the rise, affecting almost 19 million Americans (or 10% of the adult population) each year. This disorder costs U.S. businesses as much as \$51B in absenteeism and lost productivity. Within the U.S. construction industry, companies will replace at least one in four employees annually as a result of employees' failure to bond with the company and its leaders.

The quality of the connection that technology has provided requires further examination. Face-to-face conversations have been replaced by expressionless and often ambiguous e-mail. More conversations take place on cell phones than in person. Three billion telephone calls are made every day, and over 60 billion e-mails are sent worldwide every day. Text messaging has severed that connection even further, allowing short messages to be sent in text, rather than communicated verbally or in longer, more formal e-mail communication. Amazingly, the number of text messages sent and received every day exceeds Earth's population.

The rise of newer and faster technological breakthroughs has both proponents

Exhibit 1  
Peak Leaders



and critics. It would be foolish to believe that technology has not vastly improved the lives of billions of people around the globe. However, it is similarly foolhardy to believe that technology is a panacea to solve mankind's troubles. The proper place of technology comes up in many places in our society, but its role in leadership is often overlooked. Can technology be used to improve the quality of leadership, or is it a barrier, preventing peak leadership within an organization?

While technology's focus is increasing speed and connection in

the business world, leadership is fundamentally about connecting with people. (See Exhibit 1.) Leaders who function at their peak level of effectiveness are driven by a strong set of values and beliefs and are skilled at many of the things you hear and read about in the press today — articulating a compelling vision of the future, setting clear strategy, getting the right people into the right roles within the organization, ensuring organizational goals are established and achieved, inspiring people to reach their potential and building the skill and competence of the next generation of workers. Each of these leadership tasks can be enhanced through the appropriate use of technology. However, while leaders should harness the benefits of technological advancement, especially in communications, they should also consider critical issues that arise in today's high-tech/low-touch business environment. While e-mail and Blackberries are great tools for enhancing a leader's accessibility — increasing frequency of communication between leaders and followers and expanding a leader's access to information — they are frequently overused. We view this technology like a hammer, and therefore most issues, concerns, or items on task lists appear like nails, or things that can be resolved with this trusty sidekick and thick thumbs.

While technology can increase speed and connection in business, there is a fundamentally different tool that leaders must use to increase speed and connection with their people, to inspire them to reach their full potential, and to achieve remarkable business results. That tool is trust.

## TRUST

Trust, simply put, is about confidence and credibility. Trusting someone comes from faith and a belief in that person. A credible person inspires confidence as someone that can be

depended on, even in a pinch. Jack Welch once said, “I could give you a dictionary definition, but trust is something that ... you know it when you see it.”

Trust is often thought of as a social virtue and something of a soft skill that may be nice to have, but that isn't an economic engine. Trust does have considerable economic impact. Consider the purchase of McLane, a Wal-Mart subsidiary, by Warren Buffet and Berkshire Hathaway. After only two hours of meetings between the parties, a deal was reached. Buffet and Wal-Mart's representatives shook hands, and two weeks later the transaction was completed. There was no due diligence in the \$23B deal. This deal closed quickly because Warren Buffet's word is his bond, and Buffet trusted Wal-Mart representatives to uphold their promises. Stephen M.R. Covey has coined a term for this expediency as operating with the “speed of trust.” On the flip side of this coin,

when trust is low, speed goes down and costs go up. For example, in the aftermath of the 9/11 tragedy, trust in the airlines was lost due to terrorism. The speed of transportation went down, and travelers must now wait in long security lines to reach their departing gate. Costs increased, and travelers now pay for the upgraded security in order to make traveling by air safer.

Similar situations happen on construction projects. When a contractor submits a second dubious change order within a short time, the project owner may begin to lose trust in the contractor and hire a construction manager to keep an eye on his or her interests. The owner and design team will likely now ask for verification on all pricing. The contractor begins documenting everything in preparation for claims and litigation. At this point on, whenever there is a bump in the road, the process will be filled with conflict, negotiation, and disputes. Over time, unless trust is restored, it will become increasingly difficult for this particular project to be brought in on-schedule and within budget. How might the situation be different if the owner, design team, and contractor were all on the same boat and rowing in the same direction due to mutual trust?

Research by Watson Wyatt<sup>1</sup> indicates that total shareholder return in high-trust organizations is almost three times higher than the rate of return in low-trust organizations. According to the 2007 *Great Places to Work* survey, conducted by the Great Places to Work Institute in partnership with *Fortune Magazine*, trust between managers and employees is the No. 1 defining characteristic of the best workplaces.

A key ingredient for building organizational loyalty among the best employees is a trustworthy leadership team. Enron, Martha Stewart, WorldCom, and *The New York Times* scandals are a few of the recent events that have chipped away at society's trust in institutions, organizations, and leaders. In a recent survey, only 54% of consumers in the United States trusted businesses, and only 39% trusted government to do the right thing. The construction industry also has its trust issues. In a recent survey, contractors were third from the bottom on a list of the most trustworthy



occupations, surpassing only used-car salesmen and television evangelists. This is as much a perception problem as anything else since the term “contractor” is used to describe disparate enterprises from remodelers working out of the back of pick-up trucks to global firms building infrastructure. But in the end, it is up to each individual leader to build the relationships necessary to ensure that they are cultivating trust on their teams, in their organizations, and in their communities. Understanding how to build trust is one of the most valuable skills a leader can possess.

## BUILDING TRUST

Trust is a key competency for construction leaders in the new era of globalization. Construction companies are facing greater competition and opportunities from overseas firms. The speed of business is increasing due to these factors, and leaders that have built trusting relationships in their organizations will be better suited to adapt to the rapidly changing times. The core elements of trust are character, competence, and consistency. Most people consider themselves to be of strong character, highly competent, and consistent. This is because people generally hope others will judge them based on their intentions. Unfortunately, trust is not built through intentions, but rather through behaviors and actions.

Five specific behavioral attributes play the strongest role in a leader’s ability to build and maintain trust: honesty, integrity, accountability, tenacity, and authenticity.

These attributes do not imply that a person simply doesn’t lie and tries to do the right thing; they require much greater dedication and discipline.

Honesty means consistently telling the complete truth, and it involves communicating the facts clearly in order to be understood and leave the right impression. It is often easier to avoid telling the whole story, hoping that the individuals involved will come to their own conclusion or that the situation will resolve itself and no more disclosure will be necessary. Yet, these situations often backfire and erode trust. People that feel (or know) information was withheld, positioned, or postured will be much more suspect of future information they receive. Building trust requires complete honesty, even when it is painful for one or both parties of

the communication. Over-communication is preferable; the more people feel they understand the facts and motives, the more readily they will trust.

Integrity, the second behavioral attribute, involves people doing what they said they would do. Making a commitment builds hope. Further, agreeing to a request either implicitly or explicitly connotes a promise. Therefore, it is critical that leaders make commitments explicit so there is no confusion or misunderstanding regarding

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**Five specific behavioral attributes play the strongest role in a leader’s ability to build and maintain trust: honesty, integrity, accountability, tenacity, and authenticity.**

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what has been promised. Then, leaders must fulfill those promises. Doing so builds trust and models the behavior they expect to see in others. If employees sense the leader allows, accepts, or values behaviors other than those requested, they will begin to doubt his or her sincerity and lose trust. Again, it is not merely intentions that will be judged but the ability to deliver. So it is better to promise the report by Friday and deliver on Thursday than to promise Thursday and miss the deadline. Over-promising is a leading killer of trust. People will not trust others they feel cannot deliver, especially if the individual has failed to deliver in the past.

Tenacity involves determination and perseverance even in difficult situations. This attribute is a key component of consistency (one of the core elements of trust). People trust leaders who behave predictably. Tenacity requires that leaders prioritize their commitments and meet them, regardless of other emergencies that arise. It is not always possible to maintain every commitment, so a good rule of thumb is to ask: Which commitment, if broken, will have the greatest long-term impact on relationships and trust? Often the last-minute owner or client request, if unmet, will do less to erode trust than failing to deliver on a long-ago promised dinner with a

spouse. In fact, when individuals say they can't promise x, y, or z because of a prior commitment, it builds trust. The other person sees this as evidence of the person's character and tenacity about fulfilling commitments.

Accountability means taking responsibility for any unkept promises. Renegotiate any deadlines as soon as possible — before missing it. This requires honesty and candor about the situation, rather than hopefulness. It also requires courage for the person to admit he or she is unable to meet

expectations. However, this will help to clarify priorities by distinguishing which projects the person can extend. Still, the most important piece of being accountable is not the renegotiation. It is apologizing for failing to fulfill the commitment and taking responsibility to “right” the situation and rebuild trust with the offended party.

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## REPAIRING TRUST

Regardless of an individual's diligence and dedication, there are probably times when that person has failed to fulfill commitments, been caught in a “white lie,” or has otherwise damaged trust in a relationship. People make mistakes. That's life. What is important is the response. All types of relationships are built and nourished

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**People make mistakes. That's life. What is important is the response.**

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by trust. The key to rebuilding trust is to start with accountability and honesty. Admit the mistake. Take appropriate responsibility, and commit to righting the wrong. Clearly explain what is intended to remedy the situation. Follow this with integrity and tenacity. Follow through on those promises, no matter what. The more frequent and/or severe the violation, the longer it will take to restore trust. Trust is not restored or repaired often through a single “right” act, but typically requires demonstrating a pattern of trustworthiness and over-delivery on promises. Despite the effort, it is almost always worth the investment to restore trust. It is critical for maintaining trust in other relationships (word travels fast), and for generating speed and efficiency in the workplace.

The concept of a united owner-designer-contractor team all dedicated to the common purpose of a successful project is essential in today’s construction environment, and the foundation of all real teamwork is trust. Absence of trust is the failure on the part of team members to understand and open up to one another. It stems from not admitting mistakes, weaknesses, and concerns for fear of reprisal and is evidenced by a lack of healthy debate within the team.

People view technology often as the solution to the majority of problems businesses face daily. Technology can bring people together, but it also leaves them feeling more disconnected and isolated. While technology is an important tool for leaders, over-reliance and misuse can be costly. In the current rapidly changing business environment, “softer” skills like trust carry even greater importance. True credibility and confidence cannot be created through e-mails or text messages. Character, competence, and consistency reveal themselves in the every day, face-to-face interactions between people. To build truly powerful and trusting relationships, leaders must focus their energy less on their BlackBerry and laptop and more on developing deep personal relationships with their followers. The majority of communication occurs through nonverbal means, and relying too heavily on technology to communicate can create miscommunications, lead to procrastination, and create a disconnect between the message sent and the message received. If leaders wish their interactions to be truly fast and efficient, building trusting relationships will be far more effective than relying on technology alone. ■

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**True credibility and confidence cannot be created through e-mails or text messages.**

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*Vanessa Winzenburg* is a senior consultant with FMI Corporation. She may be reached at 813.636.1256 or via e-mail at [vwinzenburg@fminet.com](mailto:vwinzenburg@fminet.com). *Tim Tokarczyk* is a consultant with FMI. He may be reached at 303.398.7260 or via e-mail at [ttokarczyk@fminet.com](mailto:ttokarczyk@fminet.com). *Willie Hepworth* is a staff consultant with FMI. He may be reached at 303.398.7262 or via e-mail at [whepworth@fminet.com](mailto:whepworth@fminet.com).

<sup>1</sup> Watson Wyatt is a global consulting firm focused on providing solutions to organizations about people and financial issues.

# Intelligent Buildings: A Win-Win for Stakeholders

Market opportunities continue to develop for the IB environment, and yet, confusion still exists about contractors' roles in this market segment.

*By Ken Roper and Layne Newton*

**W**alking through the door of a small lecture room in a large public university, the lights automatically turn on. Speakers hang from the wall, as well as a projection television that the computer at the helm of the class operates. The class begins, the professor writes on the sensitive computer screen, and the lights instinctively dim to reduce glare. The professor's notes are automatically captured and e-mailed to the students once class finishes.

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Further, the professor's lecture is streamlined in real-time so students unable to attend class can login via the Internet and phone and participate in the lesson. We always knew people in universities were smart, but when did the buildings get that way?

Paralleling the growing demand for intelligent and sophisticated people is the demand for intelligent and sophisticated buildings — buildings that not only hold intelligent beings but also are intelligent themselves. An "intelligent building" (IB) is one that provides a productive and cost-effective environment through optimization of its four basic elements. These four elements include the building systems, structure, services, and management. For all of these elements, the key objective is to maximize solutions for the occupant's needs. IBs help building owners, property managers, and occupants to realize their goals in the areas of cost, comfort, convenience, safety, the environment, long-term flexibility, and marketability. Successfully implementing an

IB environment creates increased occupant productivity and satisfaction.

Market opportunities continue to develop for the IB environment, and yet, confusion still exists about contractors' roles in this market segment. Clearly, this emerging market will continue to evolve. Those choosing to participate will experience

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**IBs offer a balanced approach to all project stakeholders, including owners, managers, users, and the local and global communities.**

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a competitive advantage. Traditionally, too much emphasis is placed on the initial cost of a building project vs. the value of the final product as determined by occupant satisfaction and total life-cycle costs. IBs offer a balanced approach to all project stakeholders, including owners, managers, users, and the local and global communities.

#### **BUILDING OCCUPANTS**

The primary purpose for any commercial building is occupancy. An IB improves on that deliverable by providing easy access, comfort, an environmentally friendly and safe setting, and services that contribute to

productivity. What's more, it minimizes environmental disruption from the building and ensures the building's long-term functionality. Desirable characteristics for occupant objectives include:

- Comfort and air quality
- Occupant-based HVAC
- Individual occupant lighting control and energy feedback
- Automatic system optimization and performance verification
- Appropriate materials use
- Environmentally safe (LEED Certified)
- Connection to outside services.

IBs connect the building's IT system with the building automation systems (BAS), which provides good thermal and visual comfort to all occupants. Rather than uniform lighting, temperature control, and ventilation, control is site-specific to the location of the occupants. Occupants control these conditions, and the building systems automatically adjust to the occupants and integrate with all building systems to meet the building performance objectives. While people are in an IB office, they can control their climate, making them comfortable and more productive. Alternatively, when they are out of the office, the temperature adjusts and the lights are turned off, saving energy and money.

To enhance buildings' efficiency, connectivity with the outside environment is fundamental. Off-site monitoring, fault detection, and remote

maintenance are integral parts of the IB's network systems. For example, on average, 28 deficiencies require correction upon a building's commissioning.<sup>1</sup> Commissioning ensures that each building system is working optimally and remedies any disparities prior to occupancy. The initial commissioning carries less than a five-year ROI.<sup>2</sup> With an IB, owners can maintain building efficiency and avoid any additional disparities. Remote maintenance of the BAS ensures the building continues to work optimally, which, in turn, continues energy, time, and money savings.

Energy cost, maintenance, productivity enhancement, lower life cycle costs, and increased occupant satisfaction translate to higher rents and increased resale values for IBs. Economic analysis reveals a different focus for the IB building process. (See Exhibit 1.) Whereas construction cost is typically a major part of a buyer's mentality, with an IB, this becomes secondary.

Exhibit 1

### Economic Analysis of an Intelligent Building

		(30,000 SF) Extension of Costs
Construction cost	\$150/SF	\$4,500,000
Energy costs	\$1.57/SF	\$47,100
Maintenance and operations	\$8 SF	\$240,000
Market rate rent	\$25 SF	\$750,000
Space per occupant	250 SF per occupant	120 Occupants
Average employee costs (salary \$40,000 plus average benefits \$12,000)	\$52,000/year	\$52,000/year
Employee cost impact per SF	(\$52,000 x 120)/30,000	\$208.00
Investment for intelligence	\$15 SF	\$450,000
<b>Category</b>	<b>Estimated Benefit</b>	<b>Benefits (per SF/Year)</b>
Energy savings	12.00%	\$0.19
Operational savings	10.00%	\$0.80
Employee productivity	1.00%	\$2.08
Rental rate over market	4.00%	\$1.00
Occupancy improvement	4.00%	\$1.00

Economic Benefit Analysis		
Initial investment in intelligence		\$(450,000)
Annual benefits		
Energy and operational savings		\$30,000
Employee productivity		\$62,400
Rental rate over market		\$30,000
Occupancy improvement		\$30,000
Total annual benefits		\$152,400
Net investment year one		\$(297,600)
Payback years based on investment		2.95
Return on investment over five years		20.58%

ROI Calculation	
YR 0	-450,000
YR 1	152,400
YR 2	152,400
YR 3	152,400
YR 4	152,400
YR 5	152,400
ROI	20.58%

Source: Ehrlich, P. (2006). *Why your next project should be an intelligent building*. AutomatedBuildings.com. Retrieved 6/22/07 from [www.automatedbuildings.com](http://www.automatedbuildings.com)

## BUILDING OWNERS

Most developers and owners are not convinced that the IB system design and customization will justify their investment. Securing the low bidder is still important to owners on most projects. Systems integrators and suppliers will need to demonstrate the ROI and will play key roles in future IB projects. The economics of these future projects will focus more on total life-cycle costs. Cisco Systems and other suppliers

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**The importance of combining sustainability and building intelligence allows for building flexibility, which will only become more important in the future.**

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see a significant opportunity for their products in this emerging market. While contractors will install the required systems, systems designers, engineers, and suppliers will play major roles in project development. The retrofit market is ripe for these technology innovations since limited internal structural changes are required.

The current trend for LEED certification fits perfectly with the IB process. On average, Americans spend 90 percent of their time indoors.<sup>3</sup> This fact, coupled with growing concerns and knowledge about the environment, indoor air quality, day lighting advantages, energy consumption, and reusable materials, makes these projects

more attractive and mutually beneficial to owners. The importance of combining sustainability and building intelligence allows for building flexibility, which will only become more important in the future.

Higher occupant satisfaction translates to higher rents and lower vacancy rates. Personnel costs can exceed 100 times annual energy costs.<sup>4</sup> For these reasons, it makes economic sense to satisfy occupants. Most owners rely solely on complaints or casual communication to evaluate occupant satisfaction. However, IBs could potentially be networked to help owners determine occupant satisfaction in an effort to maintain high levels. Higher occupancy satisfaction and lower vacancy rates are key in projects' economic analysis. Combined with higher resale values, higher investment in front-end construction costs is justifiable. IBs represent an exciting opportunity for the owners and contractors engaged in the process.

## CONTRACTORS

The opportunity for contractors is enormous. Sites, materials, design, installations, structure, systems integration (see Exhibit 2), building maintenance, and economic analysis

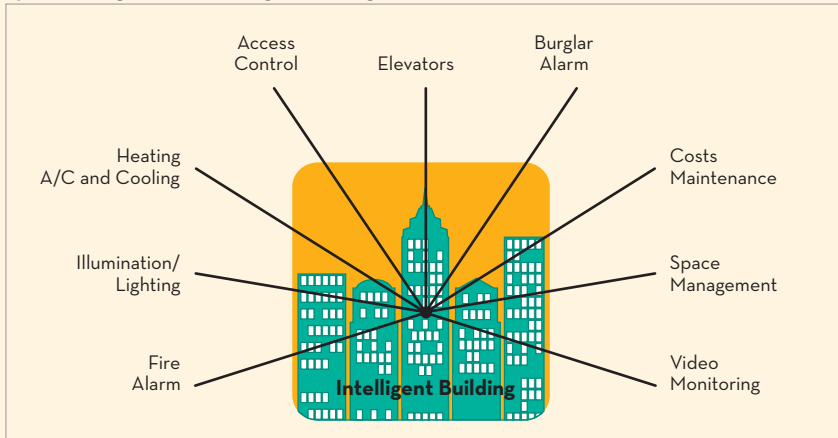
Exhibit 2

### Systems Integration: A Metaphor Between Working Environment And Human Senses, and the Senses of an Intelligent Building\*

#### Systems Integration: Working Environment and Human Senses



#### Systems Integration: An Intelligent Building



\* Huhtanen, 2000

Source: Himanen, M. (2003). *The Intelligence of Intelligent Buildings: The Feasibility of the Intelligent Building Concept in Office Buildings*. Technical Research Center of Finland

will all change. Contractors embracing the concepts and proactively moving into a position of competency will be market leaders. Some example IB projects illustrate a few of the possibilities. An airport has many distinct systems that operate lighting, HVAC, security, fire detection, and other airport services. Imagine a scenario in which all these disparate systems are manipulated with a single control. As a flight taxis to a gate, the systems anticipate the arrival and activate the air conditioning and lighting at the gate. As the luggage begins to enter the baggage claim areas, the lighting and air conditioning systems activate. Health care centers act in the same way. Computers housed in patients' rooms makes physicians' orders clear, lessening any chance of misdiagnosis. Also, rooms can transform from a patient's room with space for the family, to a surgical area, to a triage center. With its high demand for space, IBs are a natural progression for health care construction and development.

IB construction takes on a different sequencing and execution. The current method involves a carpenter hanging the doorframe and then installing the hinges, lock, and hardware. With IBs, the door may contain an electromagnet and an electrical hinge, a panic bar, and an access control system, requiring an access card and an electronic strike. All of these system components require proper sequencing



and installation. Coordination and collaboration is paramount with systems designers and engineers in addition to all the other project parties. Lack of coordination typically ends up in finger-pointing and a non-productive outcome.

Furthermore, for the contractor, there is a significant opportunity in outsourcing the operations of the IB. For the owner who does not outsource, a major predicament will be personnel turnover among building operators who know how to manage and maintain the IB. All the capital investment will

be moot, if three years down the pike, a replacement operator only knows how to cut things off and on, rather than use the sophisticated, delicate controls available. This means a continuous training opportunity for contractors (for pay) or simply providing the skilled operators themselves.

Contractors involved with green and LEED building already have a step up in IBs. Six credit categories are considered in LEED buildings, two of which strongly correlate to IB: energy efficiency and indoor environmental quality. Contractors who are shifting roles to understand the synergistic interactions of combining the shell, glazing, HVAC, and electric systems, in addition to cost and constructability feedback, assessment and measurement will have the advantage in both IB and green building projects.

## OPPORTUNITY

A significant challenge equals a substantial opportunity. Most people are in business to bring value to the public while making money. IBs represent an opportunity to develop and construct valuable buildings that are efficient economically and environmentally and that are enduring. Contractors wanting to take advantage of this opportunity should begin thinking about their company's skills and unique value proposition for owners. Develop an understanding and knowledge base for the information technology involved. For example, an electrical contractor will need to know how power metering and monitoring will tie into the network. For a lighting contractor, the required knowledge will be understanding how wireless, mesh networking fits into the system. Begin to develop relationships with building

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**IBs represent an opportunity to develop and construct valuable buildings that are efficient economically and environmentally and that are enduring.**

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owners and collaborate on what future industrial, commercial, and residential occupants will need in the space.

IB core competencies involve understanding all the economics of life-cycle costing; this knowledge alone presents a persuasive argument that sells the value of the IB project. Occupant productivity gains, reduced operating costs, and future impacts on resale value are implied benefits of the process, but owners will need to be convinced these are attainable. A design and contractor team must prove technical competency for the design and installation process. Building a resumé in the process will take time and involve a learning curve as the teams build this competency.

Building value for owners is a contractor's goal and responsibility. IB offers a unique way to do this, and getting there first offers a strong competitive advantage to those that are qualified and capable of delivering. ■

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**Ken Roper** is a principal with FMI Corporation. He may be reached at 303.398.7218 or via e-mail at [kroper@fminet.com](mailto:kroper@fminet.com). **Layne Newton** is a research analyst with FMI Corporation. She may be reached at 303.398.7259 or via e-mail at [lnewton@fminet.com](mailto:lnewton@fminet.com).

<sup>1</sup> Commissioning LEED for New Construction Projects, 2005 U.S. Green Building Council. <http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html>

<sup>2</sup> Mills, E., Friedman, H., Powell, T., Et Al., (2004). *The Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States*. Retrieved 6/22/07. <http://eetd.lbl.gov/Emills/PUBS/Cx-Costs-Benefits.html>

<sup>3</sup> The Total Exposure Assessment Methodology (TEAM) Study. EPA 600/S6-87/002. U.S. Environmental Protection Agency. 1987. <http://www.epa.gov/ncepihom/>.

<sup>4</sup> Higgins, C. (2004) *Benefits Guide: A design Professional's Guide to High Performance Office Building Benefits*. New Building Institute. P. 31

# Why Construction Has Technology Turtles

The construction industry remains a laggard in the world of technology adoption. Despite this, some remarkable applications have hit the industry recently.

*By Glenn Matteson*

**C**hange does not always come easy for the construction industry. Contractor focus is on the present, given pressing schedules, daily or hourly production targets, unpredictable working conditions, ambiguous design documents etc. The resulting slower technology adoption rate is worsened by the limited education and training of the rank and file in the industry. Where else do you still find the daily hours for a piece of equipment written in the dust on the cab's window for the mechanic or person fueling the equipment to record? Or, where else would you hear a foreman respond, "line one or line two?" when asked if he ever "goes on line" to research a problem.

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Despite this, some remarkable applications have hit the industry in recent years. Compared to other industries such as communication, consumer electronics, data processing, manufacturing, and most service industries, however, construction remains the laggard. The technologies exist today, but the challenge lies in understanding how to apply them effectively. Design and project delivery tools have arguably made the greatest advances through technology in the industry today. BIM, collaboration

software, and design sharing all are having major impacts. However, one area could produce the greatest economic gains from technology's progress, and yet it is undoubtedly the most ignored — field productivity and field management.

Construction is the largest employer in the country, and most of the industry's employees are in the field. Labor is quickly becoming the chokepoint for successful project delivery in all segments. Skilled labor, whether in a trade or supervision, is an even more precious resource and one that has been recognized as critically important

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for the industry and the economy as a whole. Needed infrastructure development and replacement can be postponed or, worse, be hit with unacceptable quality as labor scarcity looms. The trade press is filled with articles and promotions directed at increasing the quantity and quality of the American construction labor force. Here is where technology can have its most significant impact. During the 1990s, technology was a driving force that propelled world productivity beyond levels ever seen. The decentralized personal computer engaged powerful software tools that allowed industries, institutions, governments, services, and individuals to produce more goods and services faster, with less effort, and with better quality. Economists also attribute this dramatic gain in productivity as a causal factor in helping to tame

inflation. Consumers could consume more. Goods and services avoided the upward price pressure derived from increased demand. Supply could keep up with demand without increasing unit costs ... the power of productivity. Given the labor shortage, this powerful means of increasing productivity is one of the most valuable applications in construction today. Let's examine two specific areas where technology is just beginning to contribute to productivity increases in major ways.

First, equipment productivity is an extension of labor productivity. Granted, bigger, stronger machines can improve output, but they also require greater capital outlay and higher operating costs. Leveraging equipment productivity simply through larger machines may not be the complete answer. Applying those machines in a smarter way can be even better. Most heavy/highway and civil contractors today know very little about how their equipment actually behaves on the job site day to day, hour by hour. They do not know how much fuel is wasted through idling engines. They generally do not have the time or manpower to deal with the long-term consequences of weak maintenance programs or ineffectual equipment management practices. Productivity slips away in small, incremental pieces that are hard to notice because these pieces are of little or no consequence at 40-cent fuel rates and are nearly impossible to capture in metrics.

Today's "GPS" (global positioning system) solutions, as they are generically and erroneously called, were originally technologies in search of an application. Many in construction still share that view today: "Our equipment management is pretty good. We've been successful for 50 years without any black boxes tattling on the operators." Interestingly enough, similar comments were heard 20 years

ago about cell phones, 50 years ago about hydraulics, and even 100 years ago about internal combustion engines! Granted, most suppliers of "GPS" or telematic systems originally did not understand the construction industry. Meanwhile, wireless carriers and the automotive and transportation industries such as truckers and rental-car or used-car companies used this technology quite effectively for logistics management and security. Extrapolating and modifying the hardware into construction was not difficult; the difficulties lay in understanding construction's needs and applications because the construction industry itself does not know or have a consistent knowledge of equipment management and production management. It is often still just "grind-it-out" by field supervision and sometimes by clever crisis management. All the effort is manual, the knowledge tacit. The combination is, therefore, difficult to replicate or pass from one manager to another. Not until enough people from construction studied telematics and asked the appropriate questions about features and capabilities did this technology become a true aid to productivity. It took some knowledge of how to apply the technology, not just knowledge of its availability or how to create the technology.

Accurate cycle times, logistical planning of material movement, quantity measurements, and a disciplined management approach to the technology measures are having a tremendous impact on field productivity and management. Six Sigma teams using telematic technology have documented incredible successes. The "black box" originally designed to supply hours and locations can now be set to measure "events." Initially, events meant warnings about machine health, such as an engine overheating or excessive hydraulic pressure. Very quickly it became obvious that other "events" could be captured precisely in time and location. They could be recorded, communicated in real-time, and consequently acted upon to improve production results. Load counts, material quantities, and dump or load times are measured; engine idling time is identified; and maintenance/fueling procedures are optimized. Certain telematic solutions now offer the ability to automatically report the fuel consumed on any diesel engine as well as the rate of consumption over the course of the day. Such data can help identify

when the machine was idling and when it was working. The aggregated fuel use can more accurately indicate when service intervals are needed. Without any additional administration, this technology can also drive compliance with emissions requirements many states are now implementing. Fuel costs can be decreased significantly.

All of these results are positively affecting the users of heavy equipment, and subsequently, their customers are receiving faster, less costly projects. Daily feedback to the crews is accurate and automated, providing a better incentive to manage more effectively. Automatic job cost integration of equipment's actual hours can help control idling time, improve estimating rates, and reduce owning and operating costs. Raw data and hours can be fed into a job-cost system with or without cost codes. This eliminates the field's hoarding, "gamemanship," or just guessing as they manually record equipment time. An industry first, downtime, can now be definitively measured, allowing a real comparison between equipment brands, models, job sites, and operators. Production can increase on every job. The equipment hours are automatically sent each morning to the respective foreman or superintendent where they can be cost-coded via error-proof touch screens and communicated automatically back into cost accounting systems and master scheduling programs. Even the long-term aspects of managing the fleet are greatly enhanced with accurate utilization data. Hourly owning and operating costs become a truer picture, allowing much more empirical analysis on repair vs. replace decisions and overall fleet size, composition by make/model, owned, rented, leased etc. The value of all these equipment management and equipment productivity improvements are compounded when the overarching labor crisis confronting the industry is considered. More can be done with fewer or less-skilled people when it comes to equipment management and improving its productivity.

Exhibit 1 shows a hauling application for a 70-ton rigid frame truck. It works two shifts (purple and orange) and clearly shows a difference in production and fuel consumption. The graphed lines indicate the gallons per hour (vertical axis) being

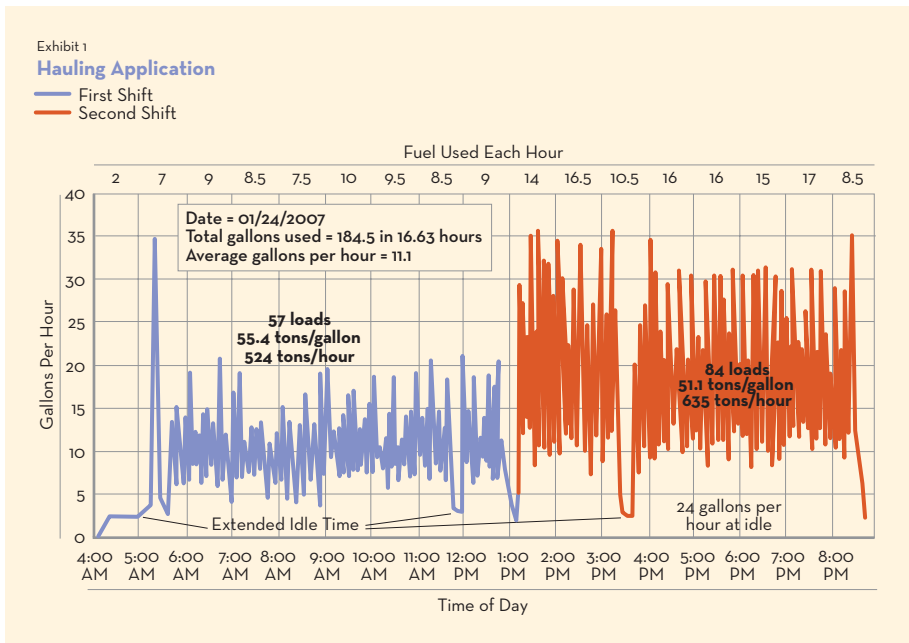
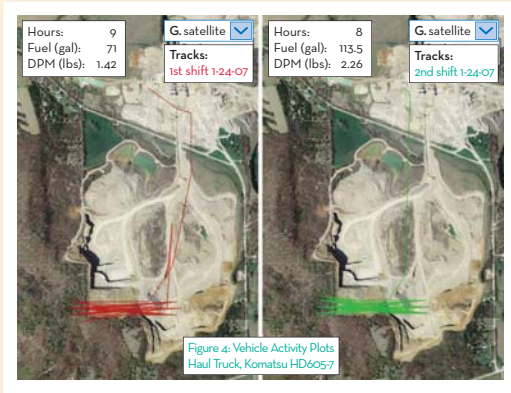


Exhibit 2  
**Quarry Operator's Satellite View**



consumed at the time of day (horizontal axis). The rise and fall in consumption rates are due to the cycle of loading, running, dumping, and returning.

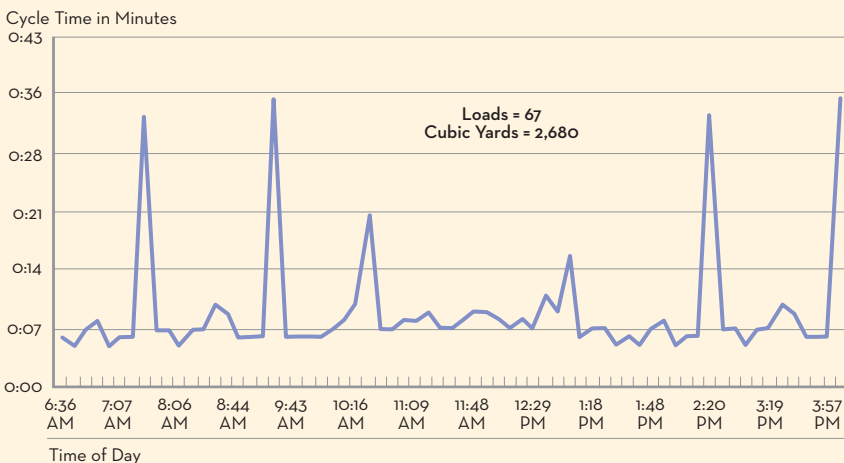
The telematic device counts the loads with a proximity switch on the dump bed, and a probe in the intake manifold measures the fuel consumption. All the data is reported once or twice per day. This quarry operator chose a satellite view (see

Exhibit 2) that clearly shows the truck was working the same area, doing the same task for both shifts. Why the difference in production and fuel burn then? Another report showed the loader was a smaller size in the first shift and took almost twice the time to load the haul truck than a larger loader used in the second shift. The second-shift truck operator was able to run faster, produce more, and not wait to be loaded. The first-shift truck operator lowered his speed and burned less fuel, but moved less material, avoiding a wait to be loaded by the smaller loader working another truck.

This technology is applicable to almost any production application — asphalt paving, mass excavation, grading, concrete placement etc. The fuel totals can be compiled into any type report or database as needed. Hard data can verify production rates used by estimating or in quantifying force account work.

Cycle times can be measured directly. (See Exhibit 3.) The spikes represent delays the truck faced over the course of the day. The telematic device can transmit this

Exhibit 3  
**Production Measurement**  
 Production Cycle Times and Load Count on Truck No. 1162 — May 22, 2006



information at midday to spot-check the morning's production, and managers can make adjustments as needed.

Jobs, supervisors, or operators can be compared and recognized for their achievements. Some contractors simply post these production charts in the field trailer or shop, and the behavioral change is practically automatic. Again, the technology designed for equipment reinforces the results expected from labor.

The second piece of technology we'll discuss directly impacts all labor. When you distill this industry down to what makes a project successful, there are really only a few elements: strong estimating with clever or innovative means and methods, solid project execution, and good luck! Since the last item is more a function of the first two, let's start by looking at project execution. After all, effective execution will provide the strong estimating and means and methods for the future. The obvious

technology play for project execution resides with the project manager's communication and analysis tools. A less obvious technology, which can overshadow even the best PMs and the whiz-bang gadgets at their disposal, directly aides labor. Almost any job description for a superintendent or foreman includes the words planning and scheduling. Projects have varying degrees of complexity, but all contain risk elements related to unknown or changing conditions. The planning and scheduling are intended to mitigate that risk. While it sounds good in theory, in practice, the majority of field managers are overwhelmed by surprises, the enemy of planning and scheduling. The reasons for surprises are numerous and widely known, but difficult to correct. They can begin with the drawings, plans, and specifications. They can be unforeseen as in literally underground or behind a wall. They can be humanly manufactured by assumptions, indifference, ignorance, improper motives etc. The list goes on, and the surprises multiply. They are worsening, too, as projects grow more complex with increased oversight, regulations, cost escalations, litigious attitudes, and generally confrontational mindsets working a zero-sum game. Pair these features with a shrinking manpower base that knows how to deal

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with it, and it's easy to get discouraged. Technology can help with the planning and scheduling in the field. A pair of critical challenges faces the field supervisor: having the ability to accurately communicate the nature of the surprise and then dealing with the subsequent delay in receiving answers. Push-to-talk voice communication has helped, but in some circles it is regarded now as a hindrance with garbled "streaming consciousness" and irritating chirps flooding the airwaves. Construction labor and supervision are generally visual in their approach to problem solving. Construction is a three-dimensional, tangible world in which the visually attuned can excel.

Continuous feedback and communication reduce the time delays between questions and answers, but the physical separation

among field, construction management, designer, and owner, and lack of visual support for assumptions have hampered effective communication ... until now.

Paperwork can be the bane of field managers, but it's the primary conduit of communication between the groups just listed that can overcome the surprises. Errors, incompleteness, and time lapses in paperwork hinder this communication form. Tediousness, obsolescence, superfluous requests, and outdated process flows can compound the ineffectiveness of paperwork. Technology today can use dynamic forms, coupled with wireless communication, to eliminate most of these problems. Photographs, voice recognition, text-to-speech, database, and server flexibility can all be tied together to improve one of the most valuable resources in construction. Today, it is feasible for the on-site field manager, armed with this technology, to solve a surprise within minutes instead of hours or days. Not only is the speed of the solution increased by an order of magnitude, but also the accuracy of communication is digitally perfect, and the parties involved have precise documentation. A typical solution like this is a "tablet" computer coupled with wireless communication and a simple built-in camera. Tablets differ from laptops in that a keyboard is not needed. Handwriting and selecting with drop-downs using a stylus or even a finger are not necessarily new, but when combined with a custom, dynamic form built specifically for that company's processes, the results can be amazing. Other sources of data input include barcode scanning, RFID (radio frequency identification), IR (infrared), GPS, Ethernet cables etc. Telepathic brain waves are not quite there yet, but just give it a little more time!

Input can be controlled programmatically, avoiding erroneous or data-entry errors. The forms can be changed in the field by authorized managers. Forms or RFIs with photos and real-time annotations from the field can be distributed immediately as an e-mail to all concerned. Answers with photos, drawings, revised plans, authorizations,

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**Construction labor and supervision are generally visual in their approach to problem solving. Construction is a three-dimensional, tangible world in which the visually attuned can excel.**

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directions, explanations, change orders etc., are sent back in real-time. Field managers can then focus on what they do best — building things. Electronic documentation provides substantiation of the project’s progress and all the aspects derived from that documentation. Imagine a job without delays or confusion because of surprises!

Could old-fashioned, improved planning and scheduling reduce surprises and consequently the flying of bits and bytes to and from electronic tablets? Remember that one of the more pressing issues facing the industry is the shortage of skilled labor and management. This technology can improve a mediocre or less-experienced field manager and help to develop the next generation of field managers as it “removes the pain of paperwork.” This technology can even translate between Spanish, English, and most of the world’s languages and provide feedback about the field’s performance in real-time.

It is well-known that field managers are motivated to complete their paperwork by seeing the benefits of that paperwork, or the results of their labor. It’s human nature to want to know, “How am I doing?” This technology can communicate in reverse to the field, providing that feedback. Job-cost reports, production targets, schedule milestones, personnel issues, and any written communiqué can be dynamically created and instantly shared. Another interesting trend from this is the rise of the “surrogate PM or scheduler.” A key tool for the field manager is the short-interval planner. A detailed outline of tasks, their expected durations, and required inputs are spelled out for a one- to two-week period. It often resembles a small, simple CPM. Traditionally, the typical field manager will complete the initial form as required by the job, but will not use it. The form will be neglected because of the work required to update it and the fact that the schedule changes before it can be updated. Drop-down boxes and touch screens allow the field manager to update activities on the tablet. An off-site manager can receive the inputs, review the impact, and

make necessary changes, reminders, notifications, or corrections. Again, as the dearth of qualified field people hits our industry, a single skilled manager can assist or even oversee multiple projects simultaneously with appropriate technology.

Other applications in construction are enhanced or even re-invented using technology. Estimators and design professionals

get real-time feedback on their means, methods, production calculations, and assumptions about job-site conditions. Site inspections are visual, universally shared, and logged. Owners are updated. Vendors are brought closer to the job and can partner with the contractor. Material management, lay down, layout, and fabrication become easier. Safety is controlled and, more importantly, better implemented. Dangerous conditions and practices can be dealt with faster. Contract control is

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## Real-time wireless documentation and data that help control labor and equipment productivity are just two of the emerging technologies applicable to the construction industry.

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managed effectively when combined with PDF formats that prevent any changes to or copying of the electronic document without cited controls or notes. Any contractor with a service department has a whole new dispatch and control system. Imagine a service-tech armed with a tablet that can be dispatched immediately to the next job. The tech can complete all material requisitions, check multiple parts inventories, review customer and equipment histories, access technical manuals or parts books, generate invoices, get live technical help, and document existing conditions with photos; the list goes on and on. The efficiency gains are only limited by the imagination. Heavy equipment mechanics realize all these same benefits. Repair time is cut and, more importantly, downtime is reduced.

Real-time wireless documentation and data that help control labor and equipment productivity are just two of the emerging technologies applicable to the construction industry. They may not be the high-profile tools used by designers who model entire structures or developments, but they impact the largest number of people in the industry. Labor and equipment account for the greatest risk to productivity, and any tool that helps manage that risk is important. The adoption of these two kinds of technology will happen rapidly once the early success stories spread. The field people using this technology will start demanding it wherever they apply for work. The contractors not prepared to provide it will lose out on not only the benefits of the technology, but also, perhaps more importantly, will lose the people who expect to use it on the job. The technology, as often is the case, originated in other industries, but as we better understand its features, the better we will become at reaping its benefits. ■

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**Glenn Matteson** is a senior consultant with FMI Corporation. He may be reached at 919.785.9291 or via e-mail at [gmatteson@fminet.com](mailto:gmatteson@fminet.com).

# Practice Makes Perfect

Contractors that figure out how to help improve the performance of their utility owner clients become invaluable to these same clients.

*By Mark Bridgers and Kathryn Robinson*

**W**hat are the most successful business strategies? The ones that are mutual and repeated. B.C. Forbes,<sup>1</sup> founder of Forbes Magazine and father of Malcolm Forbes, said it best: “Any business arrangement that is not profitable to the other person will in the end prove unprofitable for you. The bargain that yields mutual satisfaction is the only one that is apt to be repeated.”

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Said another way, contractors that figure out how to help improve the performance of their utility owner clients become invaluable to these same clients. FMI’s experience mirrors this sentiment and is borne out in a recent nationwide best practices study. Undertaken in 2006 by FMI’s utility vertical-market team, this study worked directly with the 20 largest natural gas utilities in the United States. These utilities use a mixture of internal and external (contractor) crews to perform construction, and FMI surveyed and interviewed these field resources to establish the production impact. The study goal was to establish a statistical link between an underground utility firm’s capital construction performance and the construction management and field management activities utilized. The following items were observed:

- When field crews exhibited frequent use of 21 critical management practices, productivity was the highest and cost the lowest.

- Owners that concentrate outsourcing with the fewest service providers, or perform the majority of these functions internally (another form of concentration), lower total capital cost.
- Owners that collaborate and/or integrate with this smaller number of service providers demonstrate the lowest overall capital construction cost.
- Contractors that demonstrate frequent use of critical field practices and choose to work with owners that concentrate and collaborate, generated the total highest revenue growth and profit margins.

While the results of our study are specific to utility owners and contractors, the gains available to both owners and contractors are applicable across all industry segments. In an unrelated study conducted through the support of the Construction Management Association of America (CMAA), owners achieved a 30% lower

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management cost.<sup>2</sup> This was achieved through the combination of pursuing high-value relationships with service providers and focused outsourcing of non-core activities, or through the purchase of holistic program management services.

Utility owners who integrated specific applications in the following seven best practice areas achieved superior productivity and low capital costs. For example, owners that worked directly with union representatives or external contractors to jointly implement the 21 critical management practices achieved significant improvement in performance. In the case of the owner, this shows up as a faster schedule or lower cost performance while the contractor has the opportunity to increase margins.

These best practices are highly controllable and each owner can choose to implement them, and contractors can choose to work for owners that exhibit them. In combination, these seven areas were the source of observed capital construction cost differences in the owner companies that participated in the study. Contractors who focus on helping their client improve any of these seven areas will reap the benefits of an improved owner-contractor relationship and simultaneously increase both their own as well as their client's profitability — creating a mutually beneficial relationship and one likely to be repeated in the future.

#### SEVEN BEST PRACTICE AREAS

- **Use of Contractors** — Use of third-party contractor crew resources on specific types of construction to achieve greater productivity
- **Use of Internal Crews** — Use of internal construction crew resources on specific types of construction to achieve greater productivity

- **Overhead Containment and Management** — Owner use of overhead cost resources to produce greatest output
- **Relationship and Approach to Third-Party Contracts** — The contractual, organizational, and cultural fit characteristics related to the use of third-party contractors for completion of projects
- **Internal Coordination** — Effective interaction between market fulfillment, design, construction, and material distribution/logistics management
- **Culture** — The customary beliefs, social forms, and material traits that help define how individuals tend to behave and respond in the work environment, resulting in efficient and effective organization as measured by output and financial performance
- **Field Management** — Use of field management practices to produce the greatest output

While all of these best practice areas help owners reduce their overall capital cost, they are also potential profit opportunities for contractors. Contractors that can help an owner lower the capital spend yet achieve the same output become indispensable. Perhaps the most immediate benefits can be achieved in the area of field management practices. Our study revealed that this area creates significant opportunity for contractors to improve both their own performance and the performance of their utility clients. This best practice area revolves around how contractors, and more specifically, how field labor/management is applied to put capital construction in place.

## FIELD MANAGEMENT

Our assessment of the effective use and implementation of 21 critical field management practices delineated those utilities that demonstrated superior performance and those that did not. The differences in performance related directly to the frequency of use of the 21 critical field practices.

In addition, we segregated responses from internal crews used by utilities and contractor crews in order to compare and contrast their feedback and relationship to performance. Historically, many utilities used internal crews to perform significant portions of their capital construction program. Today, outsourcing for capital construction is much more frequent, and internal crew skills on necessary capital construction are weaker today due to reliance on contractors. It is much more likely that internal crews are handling traditional operations and maintenance functions within the utility. When we compared both contractor and internal utility crews and contrasted their answers to the following questions, we found fascinating differences.

- Are there productivity differences between contractor and internal utility crews?
- What field management practices offer the greatest impact to overall construction performance?

- What efforts should utilities undertake to improve field performance with their internal crews?
- What efforts should contractors undertake to improve field performance with their crews?

Overall, the analysis demonstrated significantly higher productivity levels for utilities using contractor crews. FMI measured footages installed over a fixed time period and used a cost per foot measure calculated as the amount spent on field crews divided by the total feet installed. Exhibit 1 compares the best performing utilities and the poorest performing utilities based on how frequently they use contractor crews vs. internal crews. The poorer performing utilities use internal crews more frequently and install approximately 50% of the footage achieved by the higher performing utilities. The resulting cost per foot demonstrates a differential of \$6.46 or an improvement potential of 40% for these poorer performing utilities.

What management and labor practices allow the best performing utilities and their contractors to achieve the nearly 50% improvement in feet installed? Contractor and utility crew field management, crew leader(s), and crew members were interviewed, observed, and asked to respond to a standard survey instrument. Each individual rated their personal use and perceived effectiveness of 21 field management practices using a five-point Likert<sup>3</sup> scale. Exhibit 2 demonstrates the differences in practice use. Of the 21 questions from the survey, 20 of them demonstrate a relationship to performance. Our broader analysis that segregated utility employees from construction employees is more remarkable. The bars in Exhibit 2 represent the results of the over 1,000 survey responses. The black line represents the average contractor-supplied responses from approximately 500 crews, while the red line represents an additional 500 responses exclusively from the internal utility-crews performing capital construction.

The results demonstrate a 0.5 to 1.0 rating-point differential, where contractor responses are rated higher and demonstrate a strong relationship to the higher productivity observed. In no case did the contractor responses yield results below 3.0 or neutral, while the internal utility crews rated five questions below 3.0, indicating disagreement with the statement. Ultimately, the study demonstrated that as the perception (field crews, crew leaders, and supervisory staff) of field management practice improves, capital construction costs decrease, and productivity increases, which makes more effective and efficient field forces.

Exhibit 1

**Utility Field Productivity**

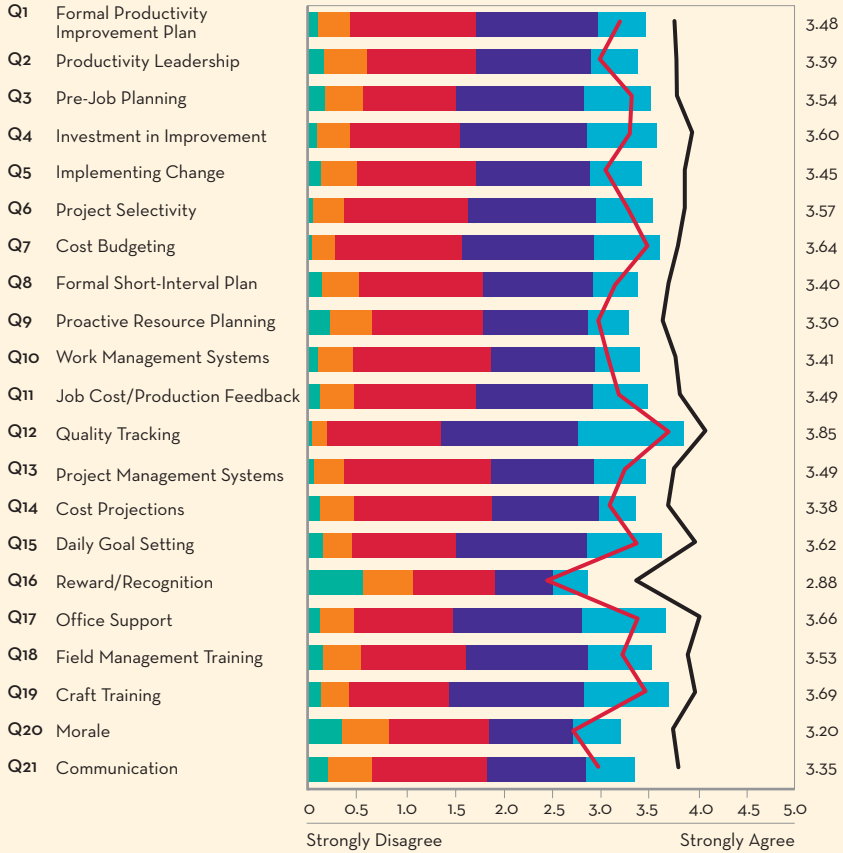
Combined Productivity	Contracted Value	Owner Crew Value	Total Construction Value	Feet Installed	Combined Productivity
Top 50 Average	\$38,561,699	\$10,324,297	\$48,885,997	\$5,106,507	\$9.57
Bottom 50 Average	\$30,787,480	\$10,469,537	\$41,257,018	\$2,573,199	\$16.03

*Note: Top 50 Average represents the half of the utility study participants who demonstrated the lowest capital cost vs. the Bottom 50 Average representing the half of the utility study participants who demonstrated the highest capital cost.*

Exhibit 2  
**Comparison of Contractor Crew and  
 Utility Internal Crew Field Management Practices**

Average score and response range; total responses = 1,190

■ Strongly Disagree    ■ Agree    — Average Contractor Responses  
■ Disagree    ■ Strongly Agree    — Average Internal Utility Crew Responses  
■ Neutral



Of all the processes studied, three demonstrate the strongest connection to driving lower construction costs and higher productivity:

- **Project Selectivity** focused on understanding which work was best suited to the crews available to perform it.
- **Quality Tracking** focused on ensuring that work put in place was installed correctly the first time.
- **Craft Training** focused on ensuring field forces were highly skilled in both technical and, more importantly, crew management techniques.

Exhibit 3 demonstrates the responses separating contractor and internal crew perceptions. The differences in observed performance and perceptions indicate that there are different opportunities for improvement depending on if field forces are supplied by a contractor or employed by the utility. Contractors that understand these differences can better position their services to add the greatest value in support of utilities attempting to drive capital cost lower. The greatest opportunities for



Exhibit 3

**Contractor vs. Internal Utility Crew Performance Improvement Opportunity**

Contractor Crew Opportunities		Internal Utility Crew Opportunities	
Q7	Cost Budgeting	Q2	Productivity Leadership
Q9	Proactive Resource Planning	Q5	Implementing Change
Q14	Cost Projections	Q8	Short-Interval Planning
Q19	Craft Training	Q9	Proactive Resource Planning
		Q10	Work Mangement Systems
		Q20	Morale

Note: See Exhibit 2 for contractor and utility crew response differences to each question listed above.

improvements in field productivity for both contractor crews and internal utility crews are detailed in Exhibit 3.

Utilities and contractors alike share most of these areas of opportunity since each requires the other to make the changes needed to achieve the resulting productivity and bottom-line benefits. For example, utilities that share work and labor resource need forecasts with contractors enable these same contractors to drive performance and productivity improvement among their crews by improving the cost budgeting and proactive resource planning processes. Without this utility information, this improvement opportunity becomes much harder to achieve, making mutual satisfaction elusive.

Deals that yield mutual satisfaction are the only ones that will be repeated and the only ones that can drive long-term relationships, boosting contractor growth and margin achievement. FMI’s 54 years of experience has witnessed contractors’ ability to build high-value relationships that result in significant financial performance improvement. In the case of contractors, we have seen an ability to absorb short-term growth rates greater than 15% with no deterioration in net margin, in combination with driving improvement in labor productivity of greater than 10% through integration with key clients. The ability to absorb and digest this change is a challenge for contractors and has been the source of many contractor failures over time.

A general belief exists that 10% improvement in productivity is far too large to be achieved. As a frame of reference, in an eight-hour day, eliminating 9.6 minutes of wasted time equates to a 2% improvement in labor productivity, and capturing 48 minutes yields a 10% improvement. This is well within reach for nearly all contractors, and something as simple as getting crews to the job site by 7:00 a.m. vs. 7:30 a.m. can bring forth this improvement. Recapture of this time goes directly to the contractor’s bottom line

Exhibit 4

## Contractor Performance Improvement Results

	Original		10% Labor Productivity Improvement and 15% Revenue Growth	
	Dollar	Percent	Dollar	Percent
Sales	30,000,000	100.00	34,500,000	100.00
<b>DIRECT COSTS</b>				
Labor	6,369,000	21.23	6,687,450	19.38
Materials	10,938,000	36.46	12,578,700	36.46
Subcontracts	7,176,000	23.92	8,252,400	23.92
Equipment	2,493,000	8.31	2,866,950	8.31
<b>Total Direct Costs</b>	<b>26,976,000</b>	<b>89.92</b>	<b>30,385,500</b>	<b>88.07</b>
<b>GROSS PROFIT</b>	<b>3,024,000</b>	<b>10.08</b>	<b>4,114,500</b>	<b>11.93</b>
Overhead	2,313,000	7.71	2,313,000	6.70
<b>NET PROFIT BEFORE TAXES</b>	<b>711,000</b>	<b>2.37</b>	<b>1,801,500</b>	<b>5.22</b>
Variance From Original Budget Dollars	—		1,090,500	
Variance From Original Budget Percent		0.00		153.38

and can yield a 3% improvement in net margin, in effect doubling the average operating profit margin of 3% that is consistently observed across the entirety of the construction industry. Exhibit 4 demonstrates these potential gains showing a 15% increase in revenue tied to a 10% improvement in labor productivity. The impact is significant for the firms able to implement these strategies.

What is this worth for utility owners? As described previously, a 30% improvement in management cost, improvement in field productivity, and lower overall capital spend are all available. The academic definition of a win/win outcome is achieving something that neither party could achieve on their own. In this case, it means combining a doubling of contractor profit while lowering overall capital spend for the owner. ■

**Mark Bridgers** is a consultant with FMI. He may be reached at 919.785.9351 or [mbridgers@fminet.com](mailto:mbridgers@fminet.com). **Kathryn Robinson** is also a consultant with FMI. She may be reached at 919.785.9211 or [krobinson@fminet.com](mailto:krobinson@fminet.com).

<sup>1</sup> Bertie Charles Forbes (May 14, 1880–May 6, 1954) was a financial journalist and author who founded Forbes Magazine. B.C. Forbes was born in New Deer, Aberdeenshire, in Scotland. In 1897, after studying at the University of Dundee in Scotland, Forbes worked as a reporter and editorial writer with a local Dundee newspaper until 1901 when he moved to Johannesburg, South Africa, where he started up the “Rand Daily Mail.” He immigrated to New York City in the United States in 1904 where he was employed as a writer and financial editor at the Journal of Commerce before joining the Hearst chain of newspapers as a syndicated columnist in 1911. He left Hearst after two years to become the business and financial editor at the New York American where he remained until 1916. He founded *Forbes* magazine in 1917 and remained Editor-in-Chief until his death in New York City in 1954, though assisted in his later years by Bruce Charles Forbes (1916–1964<sup>1</sup>) and Malcolm Stevenson Forbes (1917–1990), his two oldest sons.

<sup>2</sup> Management cost is defined in the survey as the combination of internal construction management and oversight costs in addition to external, or outsourced, program management, construction management, and oversight costs.

<sup>3</sup> A Likert scale is a type of psychometric response scale measuring either positive or negative response to a statement and is often used in questionnaires. It is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement; traditionally a five-point scale is used ranging from strongly disagree to strongly agree. A typical test item in a Likert scale is a statement where the respondent is asked to indicate their degree of agreement. Likert scales may be subject to distortion from several causes. Respondents may avoid using extreme response categories (*central tendency bias*), agree with statements as presented (*acquiescence response bias*), or try to portray themselves or their organization in a more favorable light (*social desirability bias*).